Recreational Metadata: Using Tournament Data to Describe a Poorly Documented Pelagic Fishery

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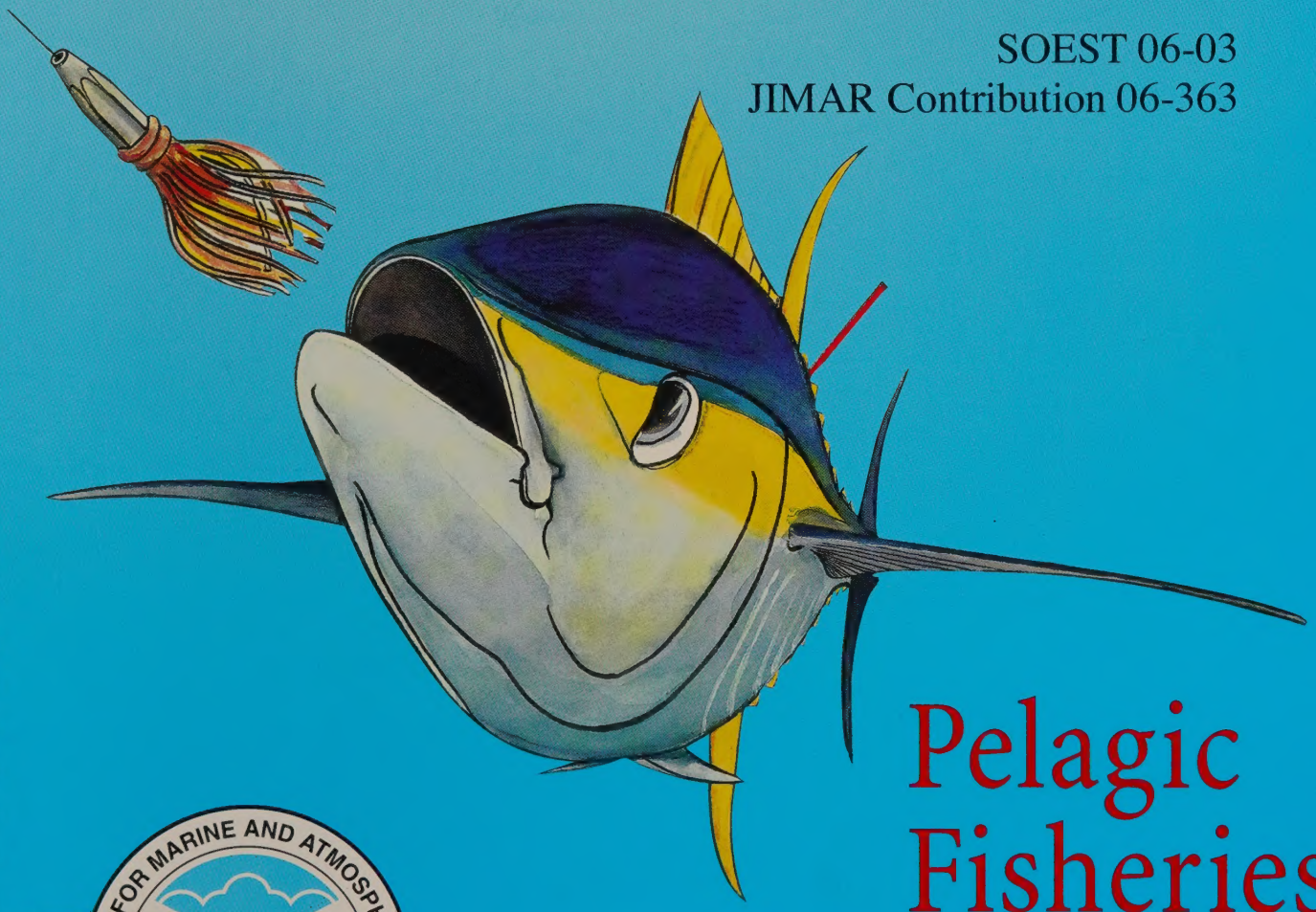

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ABSTRACT

Thousands of Hawaii residents and visitors participate in Hawaii's recreational pelagic fishery, but this activity is not well documented. In an attempt to study the history of this fishery, we compiled catch and effort data from tournaments held throughout the state from 1959 through 2003. Information regarding the species composition and weights of the catches as well as angler participation in these tournaments was compiled into a database, available for use by fisheries managers and scientists. An attempt was made to summarize the data and any trends in the results. Major findings include the heavy reliance upon targeting of fish aggregating devices during fishing trips and an increase in the popularity of tag and release fishing, especially for marlin.

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1 Introduction

This report is divided into two main sections. The first half presents information garnered from predominantly unpublished sources concerning the entire history and characteristics of Hawaii's recreational fishery. The second half documents the collection of recreational tournament data and investigates the possible uses of these data to help in the understanding of this poorly documented and relatively unregulated fishery.

Recreational fishing plays a significant role in the lives and economics of Hawaii's populace. A survey in 1996 estimated that 260,000 anglers spent over 130 million dollars in direct expenditures to pursue recreational fishing endeavors in Hawaii (Maharaj and Carpenter, 1996). Periodically, other surveys have documented the importance of pelagic recreational fishing in Hawaii, but there exists no continuous record of recreational fishing in Hawaii and most surveys point out the need for a comprehensive record of fishing activities (Hamilton, 1998; Kahiapo and Smith, 1994). This project is an effort to provide enough historical documentation to enable examination of pelagic recreational data over an historical time span of several years, thus ensuring that recreational concerns are addressed in future management decisions.

Hawaii's recreational fishermen have always enjoyed the freedom to fish without the burden of licensing and data collection from governmental agencies. Efforts to license recreational fishers began after the legislature repealed a defunct salt water licensing program in 1949 (Ball, 1975), but these efforts have continually failed due to strong public sentiment against having to pay even a nominal fee for access to ocean resources that have traditionally been free to all. Ironically, this has resulted in a lack of historical documentation on the number of recreational users and their catch that has made it difficult for agencies to adequately consider recreational fishing concerns when making policy decisions concerning the allocation of marine resources.

2 Hawaii's Recreational Fishing Sector

2.1 Background

Schug (2001) gives a concise summary of Hawaii's fishing industry from the 1820s to 1945. His account details the major demographic changes in Hawaii's population, including the arrival of migrants from Europe, Asia, and the US mainland and their impacts on fishing by the indigenous population of Hawaiians, particularly the shift from subsistence to commercial fishing. Recreational fishing in the conventional sense in Hawaii can trace its origins back to the early decades of the 20th Century. Gaffney (1999) includes a brief history of coastal fisheries in Hawaii, noting that modern sports fishing with rod and reel dates back to at least 1914 in Hilo. The oldest known shoreline fishing club in the Hawaiian Islands is the Atlapac Fishing Club formed in 1926, followed by the Honolulu Japanese Casting Club in 1929 and the Hilo Casting Club in 1933. There are presently some 26 fishing clubs in Hawaii, and a variety of different recreational fishing tournaments organized both by clubs and independent tournament organizers.

Glazier (2000) notes that recreational shoreline fishing was more popular than boat fishing before and just after World War II (WW II), and that boat fishing in this period usually referred to fishing from traditional canoes. All fishing was greatly constrained during WW II through time and area restrictions, which effectively stopped commercial fishing and confined recreational fishing to inshore areas (Allen, 1950). After WW II, the advent of better fishing equipment, new small boat hulls, and marine inboard and outboard engines led to a growth in small vessel-based recreational fishing.

A major period of expansion of small vessel recreational fishing occurred between the late 1950s and early 1970s, through the introduction of fiberglass technology to Hawaii and the further refinement of marine inboard and outboard engines (Figure 1). By the early 1960s, there were an estimated 5,300 small boats in the territory being used for recreational fishing. By the 1980s, the number of recreational or pleasure craft had risen to almost 13,000 vessels and to about 15,000 vessels in the 1990s. Hawaii also hosts between 150 to 200 boat based fishing tournaments, about 30 of which are considered major competitions, with over 20 boats and entry fees of at least $100.

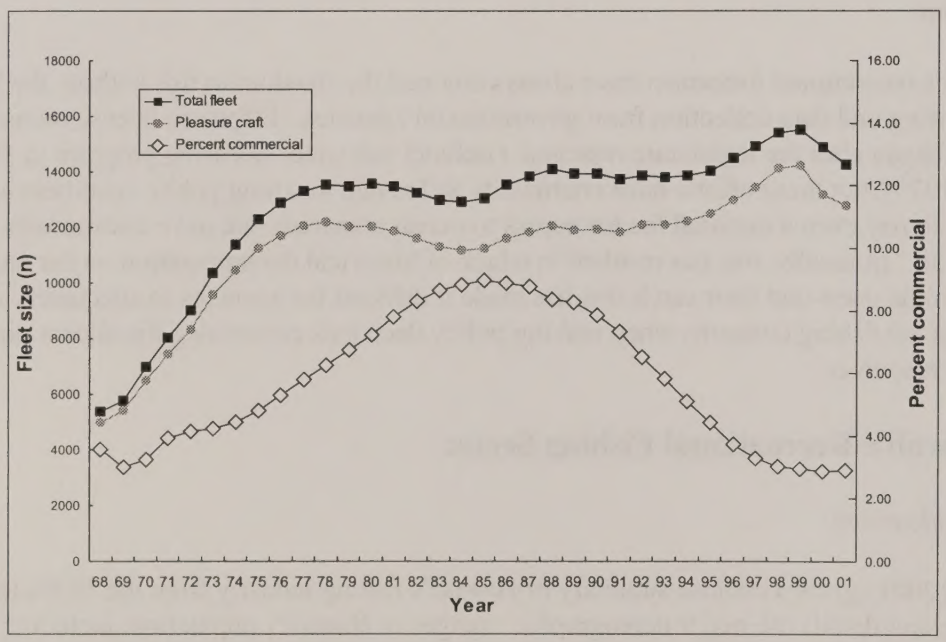

Figure 1. Annual number of small vessel fleet registrations in Hawaii. Figure shows total fleet size and percentage of vessels being registered for commercial fishing from 1968 to 2002. (Source Hawaii Division of Boating and Ocean Resources)

2.2 Catches by Recreational Fisheries

Despite the importance of recreational fishing in Hawaii, regular monitoring of recreational fishing began only recently, through a collaborative project between the State of Hawaii's

Division of Aquatic Resources and the National Marine Fisheries Service's Marine Recreational Fisheries Statistical Survey. This project, the Hawaii Marine Recreational Fisheries Survey (HMRFS), began in 2001 using a combination of telephone and shore-side intercept surveys to collect fishing effort data and estimate recreational catches.

A synopsis of the results of the HMRFS project for the year 2002 is shown in Tables 1 and 2 and Figures 2-6. The total recreational catch for Hawaii was estimated to be almost 13 million lbs, of which about 95% in terms of weight was caught from boats (Table 1). In terms of numbers of fish, roughly equal amounts were caught from boats and shore-based fishing. Interestingly, pelagic species comprise the largest volume of fish landed by weight from shoreline fishing. Pelagic fish are caught from shore in Hawaii, particularly in locations where there is a steep drop-off, such as at South Point on the island of Hawaii. Mahimahi (*Coryphaena hippurus*) comprise the bulk of this shoreline catch. Pelagic fish in total account for about 90% by weight of all recreationally caught fish landed in Hawaii.

Table 1. Hawaii recreational catch in weight from boat-based and shoreline fishing, 2002. (Source HMRFS)

Fish	Catch(lb)	
	Boat fishing	Shoreline fishing
Pelagic	11,255,283	500,960
Other species	988,408	188,093
Total	12,243,691	689,053

Table 2. Hawaii recreational catch and live discards by number, 2002. (Source HMRFS)

Live discards	Boat			Shoreline fishing		
	Catch	Discards	%	Catch	Discards	%
Pelagic	677,836	6,772	1.00%	33,386	0	0.00%
Other species	168,530	9,215	5.47%	759,487	82,001	10.80%
Total	846,366	15,987	1.87%	792,873	82,001	10.34%

The HMRFS project also gives some insights into the volume of bycatch in recreational fishing. Live discards from pelagic fishing are small, ranging from zero for shore-based fishing to one percent for boat-based fishing. Live discards are higher for other species, ranging from about 5.5% for boat based fishing to 10.8% for shoreline fishing. Overall, the discard rate for all recreational fishing is about 6%. The higher discard rates for other species may be related, in part, to the increasing volume of jacks (family Carangidae), which are being tagged and released alive by recreational fishermen.

The contributions to the catch by the six major pelagic fishes caught by boat-based recreational fishing are shown in Figures 2 and 3. Skipjack tuna (*Katsuwonus pelamis*) is the most commonly caught pelagic species taken by recreational fishermen in terms of numbers, but only a minor fraction of the total catch by weight. The biggest contributions in terms of catch by weight are by yellowfin tuna (*Thunnus albacares*), blue marlin (*Makaira mazara*), wahoo (*Acanthocybium solandri*), and mahimahi. Recreational fishing activity in 2002 ranged from 50,000 to 100,000 recreational trips per two-month period (Figure 5), with a peak in fishing activity from September to December.

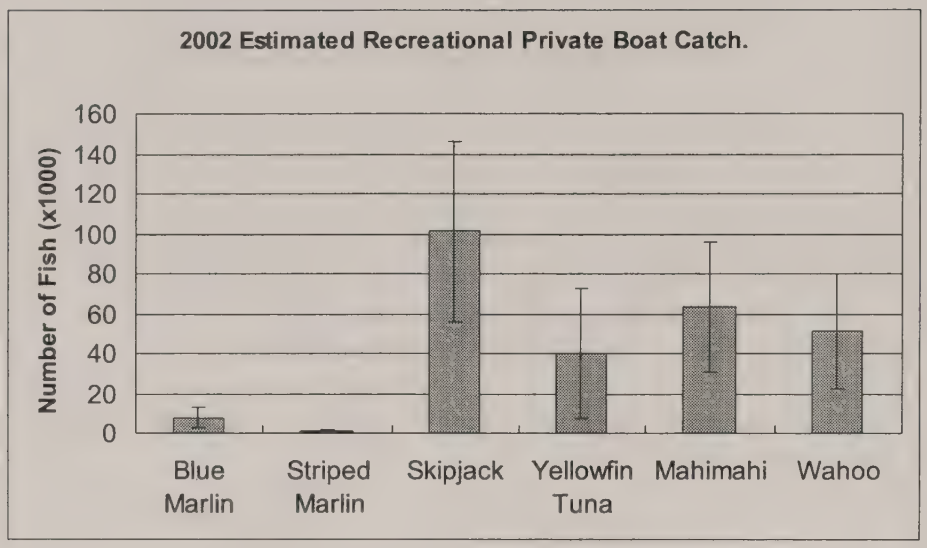

Figure 2. Estimated annual number (95% confidence intervals) of recreationally caught pelagic fish in 2002. (Source HMRFS)

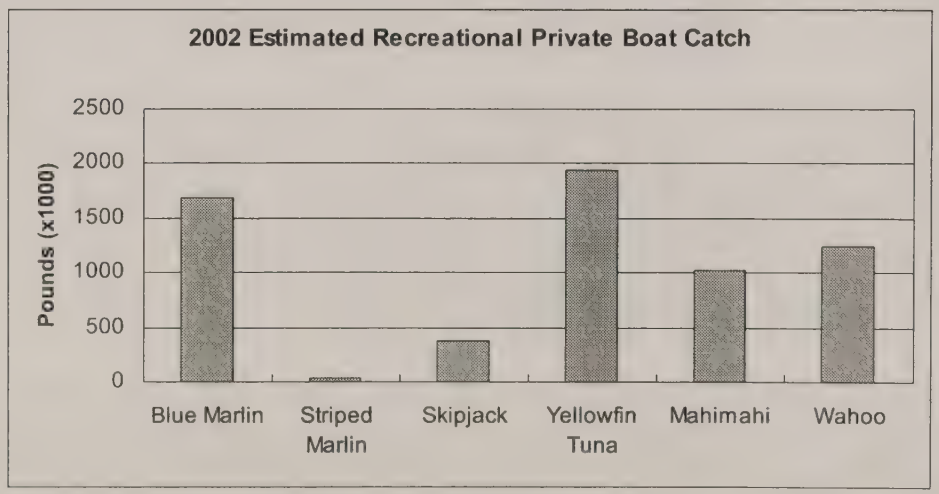

Figure 3. Estimated annual weight of recreationally caught pelagic fish in 2002. (Source HMRFS)

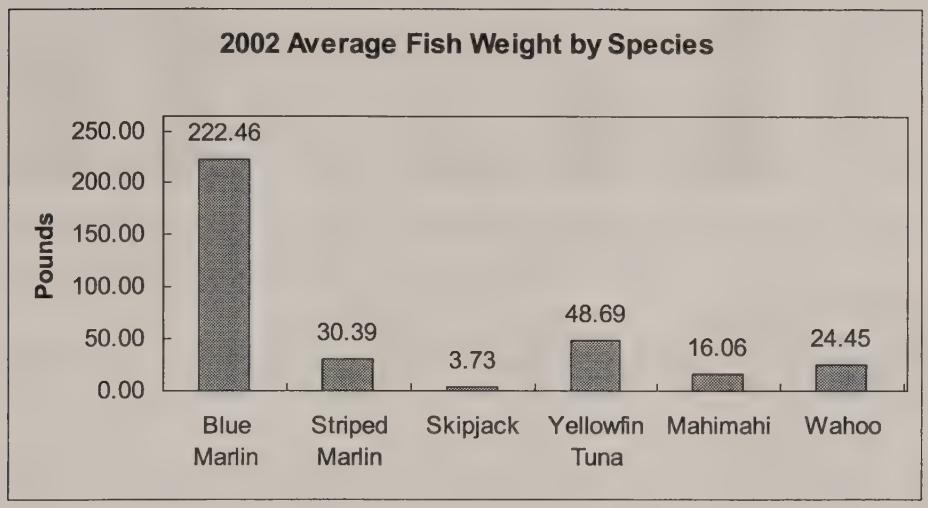

Figure 4. Estimated average weight of recreationally caught pelagic fish in 2002. (Source HMRFS)

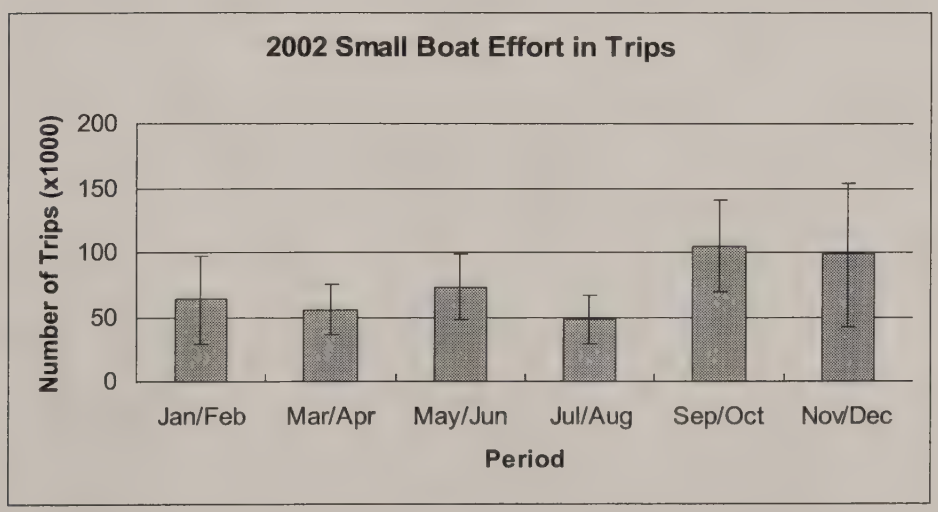

Figure 5. Bimonthly fishing effort and 95% CI for recreational fishing vessels in Hawaii. (Source HMRFS)

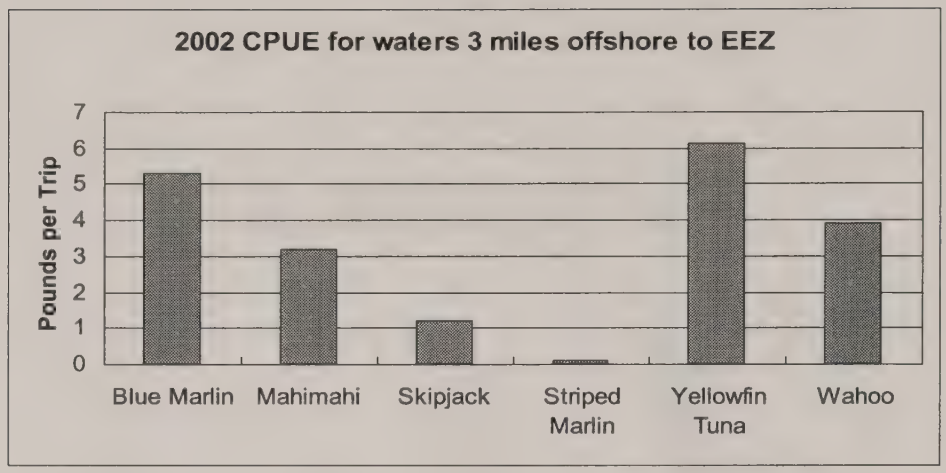

Figure 6. CPUE by species for recreational fishing vessels for waters 3-200 miles offshore. (Source HMRFS)

Due to the recent introduction of the HMRFS project, there is little information on the long-term trends of recreational fishing in Hawaii. However, the National Marine Fisheries Service Southwest Fisheries Science Center conducts an annual postcard survey of recreational anglers targeting billfish throughout the Pacific and Indian Oceans, including Hawaii. Based on the survey results, an annual time series of blue and striped marlin (*Tetrapturus audax*) catch per unit of effort (CPUE) is produced in the annual Billfish Newsletter. Figure 7 shows the time series of blue and striped marlin CPUEs in Hawaii between 1980 and 2002. Striped marlin CPUEs have shown a rising trend over this 20-year time series, while blue marlin CPUE increased up to the early 1990s and then declined to values observed in the early part of the time series.

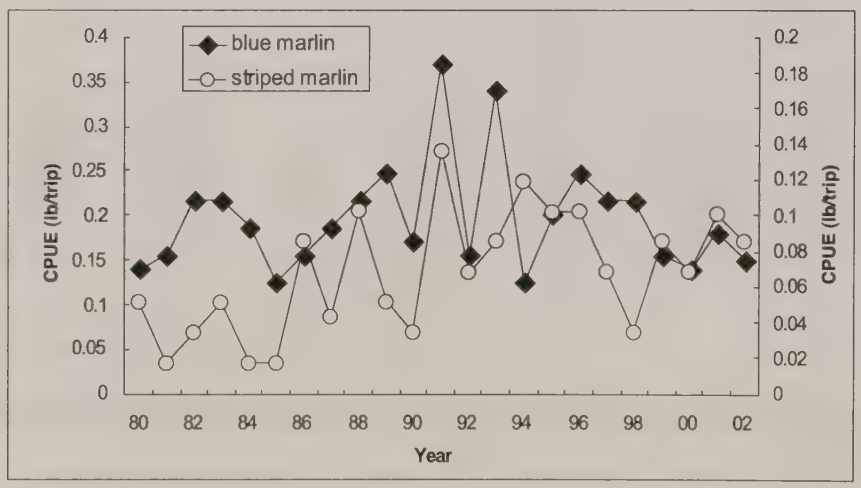

Figure 7. CPUE of recreationally caught blue (left axis) and striped (right axis) marlins in Hawaii. (Source: NMFS-postcard survey)

2.3 Charter Vessel Sportsfishing

Although classed as a commercial fishery in Hawaii, and a fishery where most of the catches are sold, the charter vessel fishery is conducted primarily for recreation. This can be seen by comparing catches of charter vessels and those of commercial trollers (Table 3). Most charter fishing in Hawaii targets blue marlin, which in 2002 formed about 50% of the total annual charter vessel catch by weight (Table 3). Although commercial troll vessels also take blue marlin, this species forms only about a quarter of their catch, with the majority of the target species being yellowfin tuna, mahimahi, skipjack tuna, and wahoo (Table 3). Unlike other parts of the US, there is little recreational fishery interest in catching sharks in Hawaii.

Table 3. Comparison of species composition of landings made by Hawaii pelagic charter vessels versus commercial troll vessels in 2002

Species	Charter vessels		Commercial trollers	
	Landings (lb)	Percent	Landings (lb)	Percent
Mahimahi	71,741	17.33	514,386	29.88
Skipjack Tuna	18,712	4.52	173,982	10.11
Wahoo	31,115	7.52	311,715	18.11
Blue Marlin	196,084	47.38	215,365	12.51
Yellowfin Tuna	57,633	13.92	375,431	21.81
Others	38,069	9.33	130,569	7.58
Total Pelagics	413,893	100.00	1,721,448	100.00

In Hawaii, there is considerable variation in charter vessel catches between the various islands (Table 4), with the largest charter vessel fishery based in Hawaii. In 2002, charter vessel catches on the island of Hawaii accounted for over half of the total charter vessel landings within the state, with Maui and Oahu charter vessels responsible for most of the remaining catch. The islands of Kauai and Molokai make minor contributions to the charter vessel catch, with no charter fishing on Lanai.

Table 4. Charter vessel catches in Hawaii by island during 2002

Island	Catch (lb)	Percent	Trips	Percent	CPUE (lb/trip)
Hawaii	269,120	65.02	3,260	53.27	82.55
Oahu	59,051	14.27	1,631	26.65	36.21
Maui	62,173	15.02	713	11.65	87.20
Kauai	23,550	5.69	516	8.43	45.64
Molokai*	NA		NA		NA
Lanai*	NA		NA		NA
Total	413,893	100.00		100.00	67.63

* DAR confidentiality protocols prevent reporting 2002 charter vessel activity for Molokai and Lanai.

Most charter vessel fishing on the island of Hawaii is conducted from Kona's small boat harbor at Honokohau, and about two thirds of the charter vessel catch consists of blue marlin (Table 5). Elsewhere, mahimahi dominates charter vessel landings, with blue marlin comprising between 2% and 30% of catches. Other important species in the charter vessel catches, depending on location, are yellowfin tuna, wahoo, shortbill spearfish (*Tetrapturus angustirostris*), and skipjack tuna.

Table 5. Composition of charter vessel catches in the Main Hawaiian Islands during 2002

Hawaii Species	Landings (lb)	Percent	Kauai Species	Landings (lb)	Percent
Blue Marlin	162,882	60.52	Skipjack Tuna	6,579	27.93
Yellowfin Tuna	41,892	15.57	Yellowfin Tuna	6,359	27.00
Wahoo	14,989	5.57	Wahoo	4,489	19.06
Striped Marlin	13,242	4.92	Mahimahi	3,894	16.54
Mahimahi	21,470	7.98	Blue Marlin	495	2.10
Others	14,465	5.44	Other	1,735	7.37
Total	269,120	100.00	Total	23,550	100.00
Oahu Species	**Landings (lb)**	**Percent**	**Maui Species**	**Landings (lb)**	**Percent**
Mahimahi	28,830	46.37	Blue Marlin	21,215	35.93
Blue Marlin	11,492	18.48	Mahimahi	17,547	29.71
Yellowfin Tuna	7,090	11.40	Wahoo	7,232	12.25
Skipjack Tuna	6,883	11.07	Striped Marlin	5,293	8.87
Wahoo	4,405	7.09	Shortbill Spearfish	1,482	2.51
Others	3,473	5.59	Others	6,336	10.73
Total	62,173	100.00	Total	59,051	100.00

Annual time series of charter vessel CPUEs from 1981 to 2002 are shown in Figures 8-14. Blue marlin, wahoo, mahimahi, and yellowfin tuna CPUEs all show some similar trends, demonstrating a significant decline in catch rates through the 1980s and a period of stability (blue marlin, yellowfin tuna) in the 1990s or increasing trends in catch rates (wahoo, mahimahi). Catch rates for other commonly caught species (e.g., shortbill spearfish, striped marlin, and skipjack tuna) are more variable between years, but appear to be relatively stable.

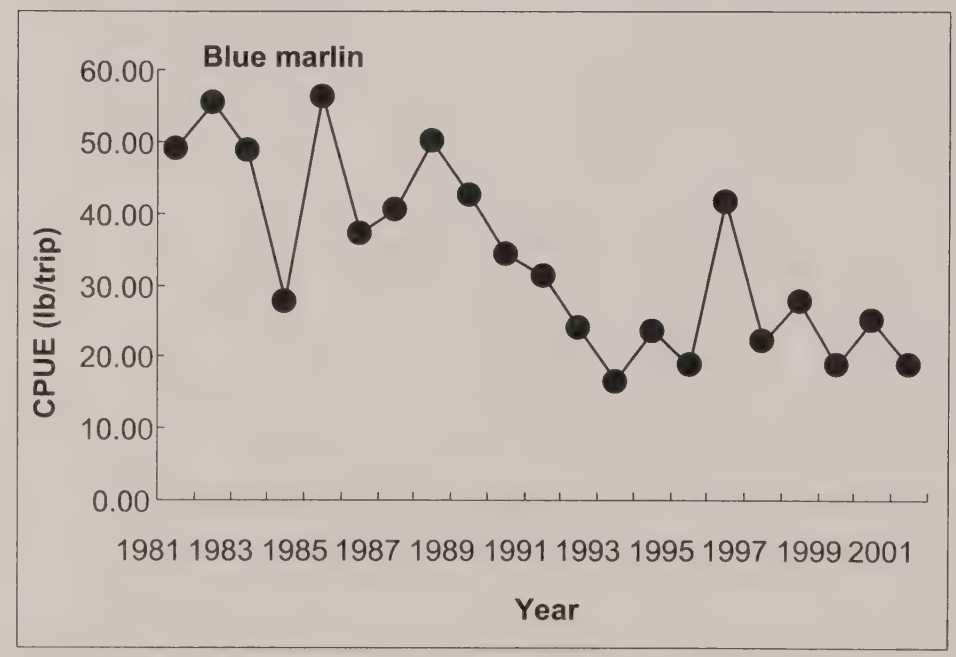

Figure 8. Annual CPUE for blue marlin in the Hawaii charter vessel fishery.

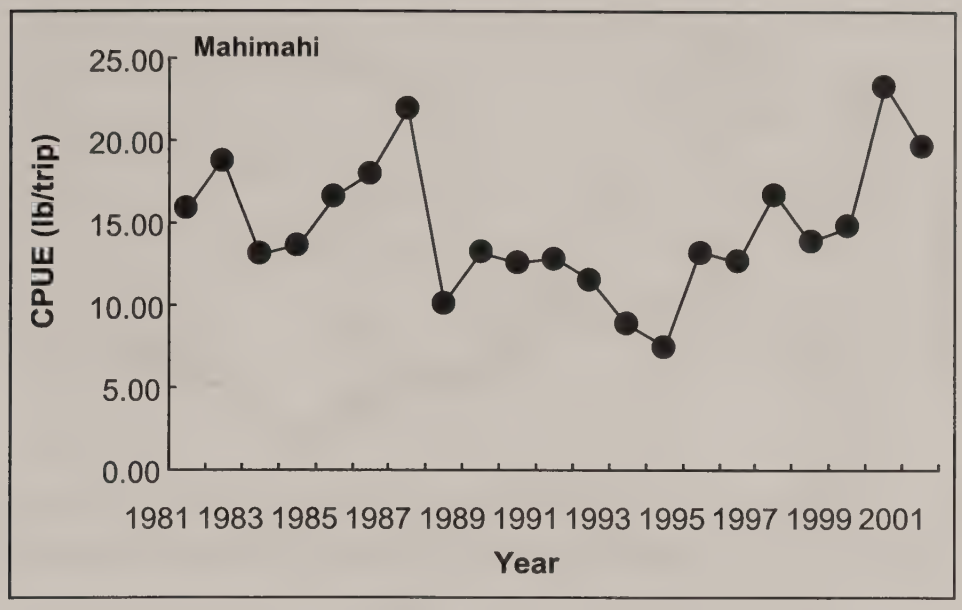

Figure 9. Annual CPUE for mahimahi in the Hawaii charter vessel fishery.

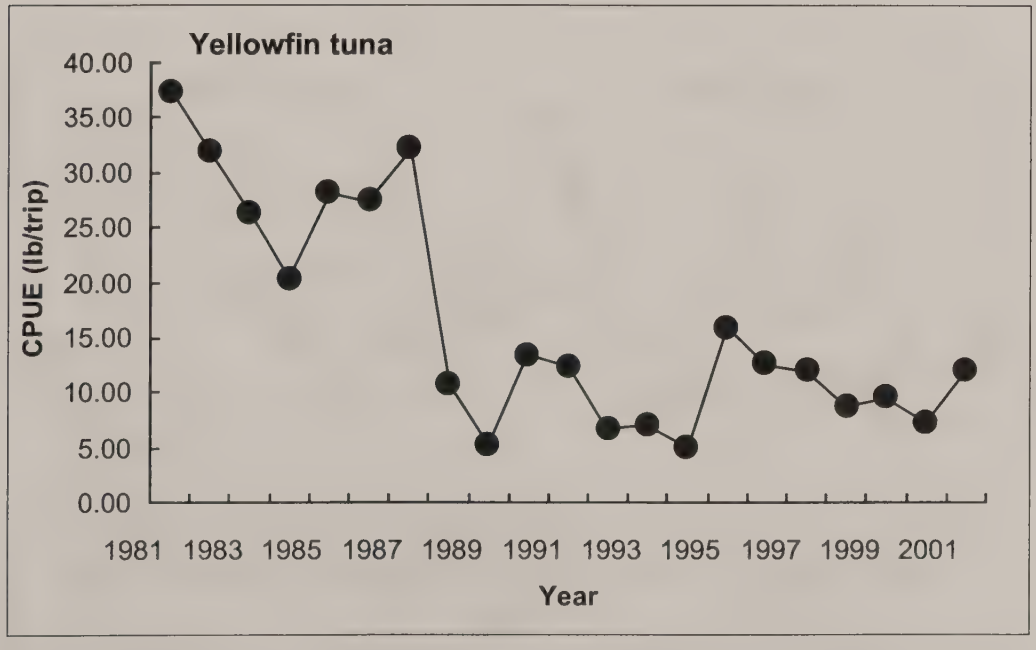

Figure 10. Annual CPUE for yellowfin tuna in the Hawaii charter vessel fishery.

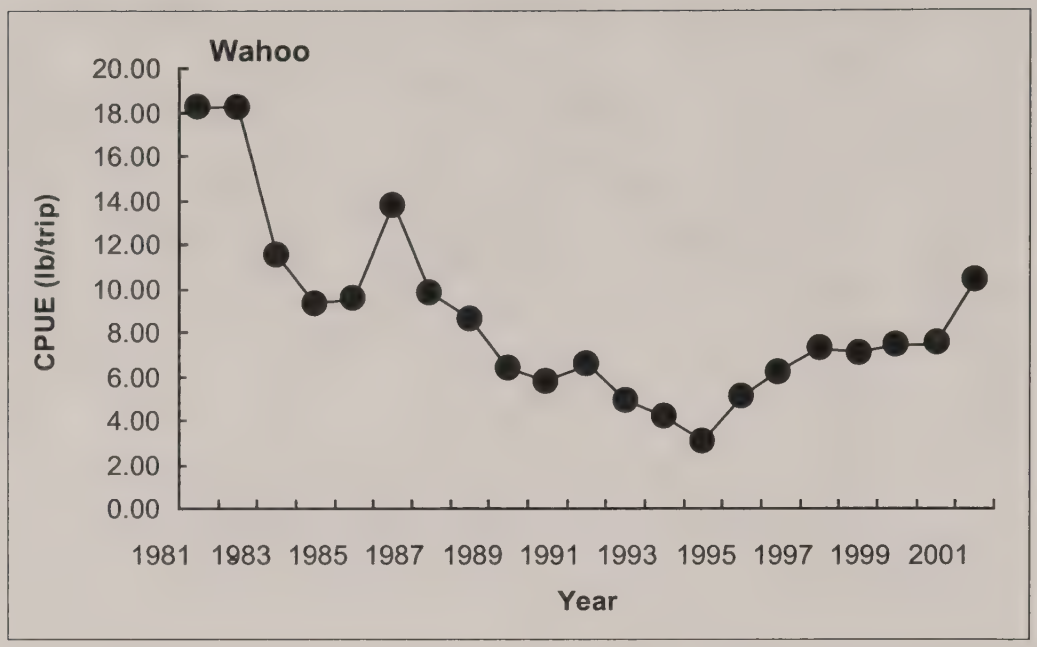

Figure 11. Annual CPUE for wahoo (ono) in the Hawaii charter vessel fishery.

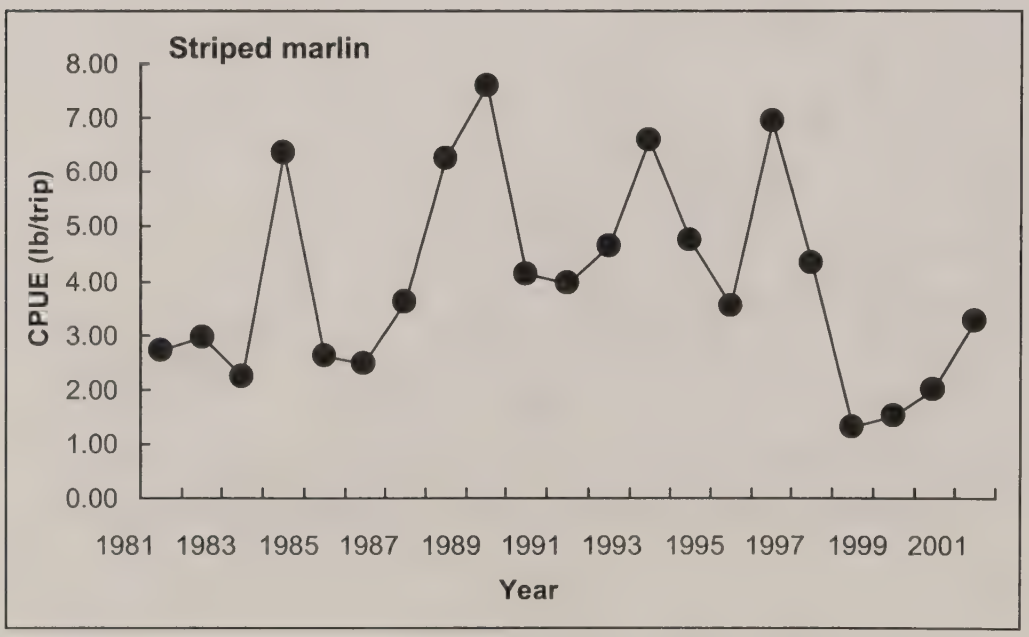

Figure 12. Annual CPUE for striped marlin in the Hawaii charter vessel fishery.

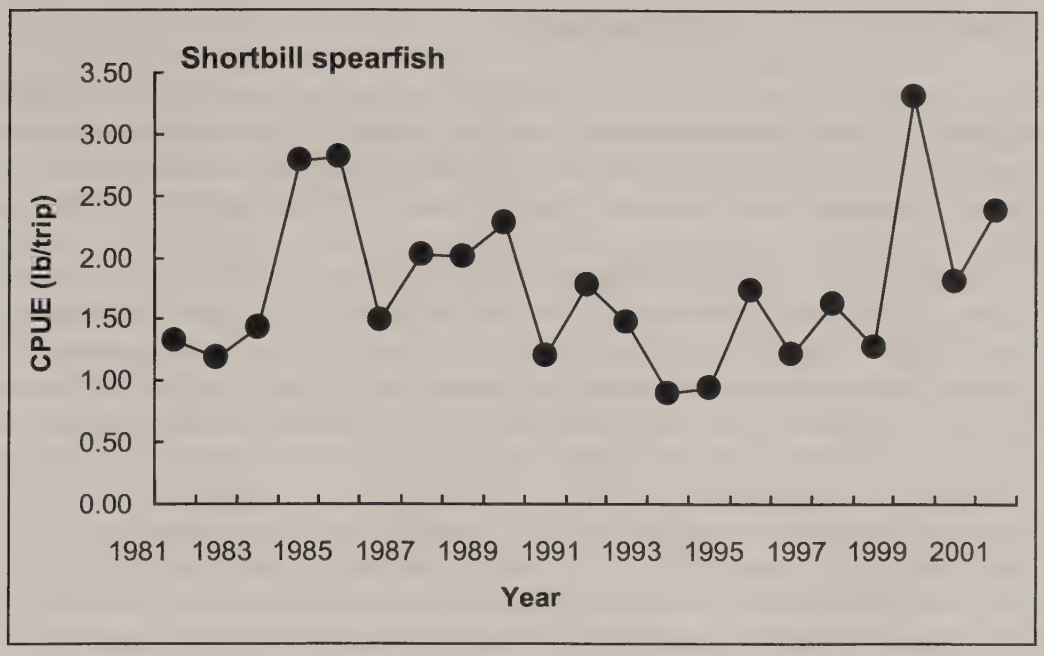

Figure 13. Annual CPUE for shortbill spearfish in the Hawaii charter vessel fishery.

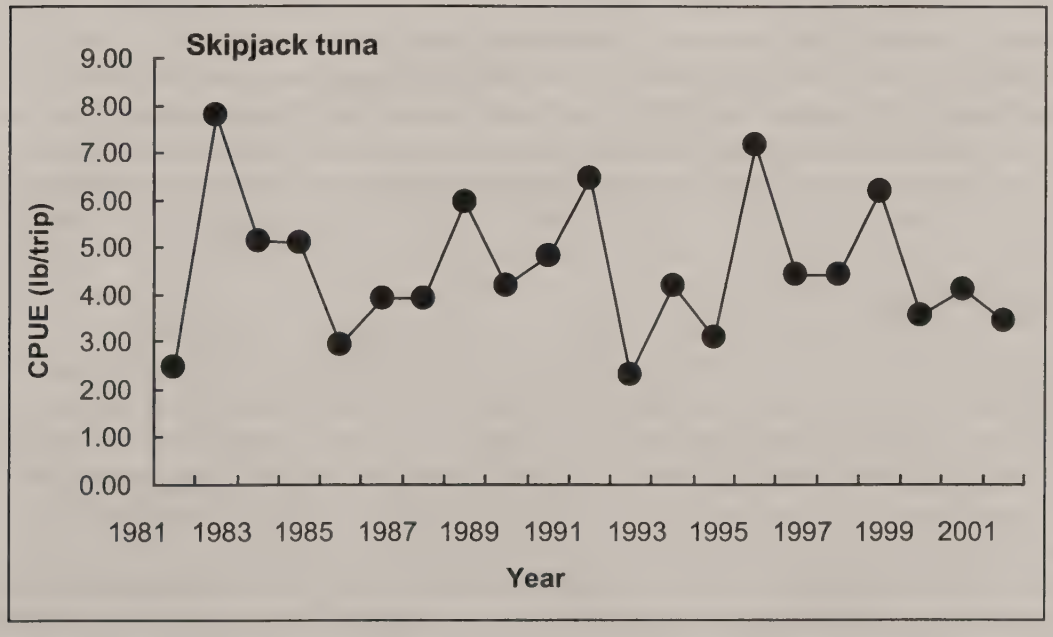

Figure 14. Annual CPUE for skipjack tuna (aku) in the Hawaii charter vessel fishery.

3 Hawaii's Recreational Tournaments

Though no official record of Hawaii's recreational fishery sector exists, much information is available in the form of surveys, previous studies, club records, newspaper articles, and fishermen's logbooks. The Recreational Meta-Data Project was initiated to document and compile, into database format, sources of Hawaii's pelagic recreational fishing information.

Early in this project, it became apparent that the largest source of pelagic recreational fishing records was fishing tournaments. These 1-5 day fishing competitions are usually well documented so that the people who run the events can distribute prizes equitably. The tournament records document the number and weight of all fish caught as well as nominal daily effort, i.e., the number of boats participating per day. Because tournament rules require strict adherence to start and stop fishing times and weigh-in requirements, the records may provide accurate information on nominal fishing effort. However, reporting is not mandatory, so these records may never be made available. It should be noted that tournaments represent only a fraction of all recreational fishing. Both catch composition and effort reflect the unique rules of the individual tournaments. The database is limited to the tournament data that were provided by the organizers and clubs and should not be considered to be an exhaustive account of fishing tournament catch and effort for the past several years. Given the paucity of historical recreational fishing information available, the database does provide substantial value as a reference. The tournament records provide repetitive catch and effort data in an arena where such data are scarce.

The data provided in the database and summarized below comprise the only known collection of the historic recreational pelagic sport fishing catch and effort data in Hawaii. These data may be used as a guide in further studies and to draw generalizations about the changing trends of recreational fishing throughout the years. The database is available for use by fisheries managers and scientists upon request. Previously conducted research and surveys are available on our website: http://www.pifsc.noaa.gov/fmep/recreation/index.html.

4 Methodology

Though there are many publications regarding sport fishing in Hawaii, few include catch and effort data. As no previous studies or surveys provided the data needed, a concerted effort was made to contact recreational anglers. An article was written in the Hawaii Fishing News monthly magazine, introducing the project and requesting information. The largest clubs and tournaments in Hawaii were contacted and asked to participate by sharing their catch and effort data. Many reacted positively, providing weigh-in summaries, catch reports or tournament summaries to the project. These were photocopied, and catch and information were entered into a database. Participating clubs and tournament organizers received graphic summaries of their catch data, and many of these have been distributed to participants or included in newsletters.

Records from tournament organizers and clubs included: radio logs, weigh-in slips, weigh-in summaries and catch records. Radio logs contain the data collected during fishing, reported

by the individual anglers or boat captains. Most tournaments require radio or phone contact after fish are hooked and boated or released to ensure that tournament rules are followed. The radio logs commonly include the time the fish was hooked, boated or both, team or boat name and number, the type of fish and an estimated weight. Weigh-in slips, in contrast, are completed after fishing. They are filled in by the official tournament weighmaster (who is often certified by the International Game Fishing Association {IGFA}) as a fish is brought to the scales. Generally, these records include the species and weight of the fish, the team/boat/angler name or number and a signature of the tournament judge. Catch records are similar, but are usually filled out by the angler and may include the area where the fish was caught and information regarding the equipment used to catch the fish, including: line test, hook sizes, and types of lure. Weigh-in summaries are simply a tournament-generated summary of all fish weighed in on a single day of the tournament and usually include only the team or boat, fish species, and weight.

We utilized these records to create a database with the following categories: identification number, tournament, date, year, month, tournament day, catch number, total number of boats, team name, team number, boat name, boat number, angler name, species code, species, quantity, tag and release information, weight and/or estimated weight, points, lower jaw fork length, area, island, location, line, bait type, hook type, fish condition, number of hooks, time hooked, time on board, time fought, data type, data source, fishing method, boat type, and comments.

A unique identification number was assigned to each entry. The tournament name and date were included to identify each event, with the month and year provided in separate columns simply to facilitate database searches and summaries. "Tournament day" was used in multi-day tournaments, such as the Hawaiian International Billfish Tournament (HIBT) to indicate on which day of the event fish was caught; "catch number" similarly provided the order in which the fish were caught for multiple entries on the same day by the same team or boat.

The boat name and number (given by the tournament) were included in the database as well as the team and angler name. For confidentiality reasons, the boat and angler names will not be available to those seeking to use the database. The total number of boats in the tournament was not always available, as we were often provided only with weigh-in slips. When tournament-assigned boat numbers were available, the highest number was used as the total number of boats, possibly resulting in an underestimate of effort. When no boat number was available, the number of boats reporting catch was used to represent total number of boats, also resulting in an underestimate of effort.

The species recorded on the weigh-in slip or summary was used in the database. These names include local common names and no attempt was made to determine the actual species of an entry listed as "marlin" or "billfish". Reports of wahoo, dolphin, or yellowfin tuna were included as ono, mahimahi, and ahi, respectively. Though spelling discrepancies were corrected, all other entries were input as provided. A two or three letter species code was used by the HIBT to record fish caught; for example PBu refers to Pacific blue marlin.

The tag and release column was marked "yes" if a fish had been tagged and released according to tournament policy. No "lost" fish were included in this category. Participant estimated weights were recorded for fish that were released. Though no award was given based upon these estimates, the accuracy of these numbers should be considered with skepticism. At the Lahaina Jackpot tournaments, the number of points awarded to a tagged and released fish was used as its estimated weight, (e.g., any fish over 200 lbs. would be weighed), so tagged and released fish were often "estimated" to be 200 lbs., thus gaining 200 points for the fisherman. Estimated weights were also reported in radio logs in tournaments requiring boated fish to be called in via radio or phone. For some tournaments, the only data we received were radio logs, reporting only estimated weights.

Actual weights usually referred to the weight of a single fish as weighed on official tournament scales, sometimes by IGFA certified weighmasters. Occasionally, combined weights were included, similar to the parameter, "quantity." These were input as reported.

The time hooked and time on board were often recorded and used to estimate time fought. The fishing method, when specified, was trolling, and boats other than powerboats were differentiated under boat type.

For fish that were tagged, the condition of the fish upon release was recorded. Tag numbers or additional information was included under comments. As stated above, points were given for released fish, though this was usually not recorded in weigh-in summaries, weigh-in slips, or radio logs. Only HIBT provided data sheets reflecting points. Initially they also reported lower jaw fork length (LJFL), the line test, whether bait (live or dead) or lures were used, type of hook (circle or J), and the number of hooks. All of these were input when provided.

For all tournaments, the island and location (either town or map direction) of the harbor out of which the tournament was run was included in the database. The data type was classified as radio logs, weigh-in slips, weigh-in summaries, or catch records, as described above. The club or tournament organizer was considered the data source. Each caught fish was described as completely as possible.

5 Database Summary

The following (Table 6) describes the catch and effort data included in the database. In all, there are 37 tournaments/events included in the database some spanning multiple years.

Table 6. Tournaments included in the database.

Tournament	Data source	Year	Number of fish	Average number of boats	Data type	Location	Island
Kikiaola Westside	Kikiaola West Side Fishing Club	2000-01	444	26	Radio Log		Kauai
Port Allen	Port Allen Fishing Club	1999-2001	340	37	Radio Log		Kauai
Rainbow	Port Allen Fishing Club	2000-01	131	28	Radio Log		Kauai
Ahi Fever	Waianae Boat Fishing Club	1997-98, 2000-01, 2003	1265	236	Weigh in summary	Leeward	Oahu

Tournament	Data source	Year	Number of fish	Average number of boats	Data type	Location	Island
President's Day	Hawaii Yacht Club	1990-91, 1996, 1998-2001	215	15	Weigh in slip	Leeward	Oahu
Spring Fishing	Hawaii Yacht Club	1990, 1996, 1998	47	13	Weigh in slip	Leeward	Oahu
Wahine Invitational	Hawaii Yacht Club	1996. 1998-2001	30	11	Weigh in Summary	Leeward	Oahu
Pure Jackpot	Keehi Fishing Club	2003	30	35	Catch Summary	Leeward	Oahu
Keehi Jackpot	Keehi Fishing Club	2003	14	44	Weigh in summary	West	Oahu
Lahaina Jackpot	Lahaina Yacht Club	1991, 1995-2003	1614	104	Weigh in summary	Lahaina	Maui
Wahine Jackpot	Lahaina Yacht Club	1996-99, 2001-03	262	35	Weigh in summary	Lahaina	Maui
Hilo Trollers Monthly	Hilo Trollers	1981-86, 1993-96, 2003	2002	20	Catch Records	Hilo	Big Island
Labor Day	Hilo Trollers	1983	350	27	Catch Records	Hilo	Big Island
Wahine	Hilo Trollers	1983	116	13	Catch Records	Hilo	Big Island
Apples & Oranges & Sour Grapes	Hawaii Yacht Club	1996	3	12	Weigh in Summary	Leeward	Oahu
Cockeyed Mayor	Hawaii Yacht Club	1991, 1996, 1998-2000	102	13	Weigh in slip	Leeward	Oahu
Do or Die	Hawaii Yacht Club	1986, 1991, 1996, 1998-2000	60	9	Weigh in slip	Leeward	Oahu
Ho'ole'a	Hawaii Yacht Club	1989-91, 1999	360	59	Radio Log	Leeward	Oahu
Independence Day	Hawaii Yacht Club	1996, 1998-2000	37	8	Weigh in Summary	Leeward	Oahu
King Kamehameha	Hawaii Yacht Club	1996, 1998-2000	56	14	Weigh in slip	Leeward	Oahu
Memorial Day	Hawaii Yacht Club	2001	43	7	Weigh in Summary	Leeward	Oahu
No Alibi/Spring	Hawaii Yacht Club	1999-2000	45	21	Weigh in slip	Leeward	Oahu
Offshore Hunter	Hawaii Yacht Club	1999-2001	76	12	Weigh in slip	Leeward	Oahu
Big Island Marlin Tournament	Tropidilla	2002-03	17	15	Catch record	Kona	Big Island
Firecracker Open	Tropidilla	2001-03	108	43	Catch record	Kona	Big Island
Kona Classic	Tropidilla	2001-03	120	37	Catch record	Kona	Big Island
Maui Jim Championship	Tropidilla	2002	11	7	Catch record	Kona	Big Island
Okoe Bay	Tropidilla	2001-02	42	15	Catch record	Kona	Big Island
Skins Marlin Derby	Tropidilla	2001-03	83	20	Catch record	Kona	Big Island
Heavy Tackle	World Billfish Challenge Hawaii	1999, 2001-02	91	16	Catch Record	Kona	Big Island
Ko Olina	World Billfish Challenge Hawaii	2002-03	16	6	Weigh in summary	Leeward	Oahu
Light Tackle Shootout	World Billfish Challenge Hawaii	1999, 2001, 2002	51	6	Weigh in summary	Kona	Big Island
Shoot Out	World Billfish Challenge Hawaii	1999, 2002	29	7	Catch Record	Kona	Big Island
Hawaiian International Billfish Tourn.	Hawaii International Billfish Association	1959-73, 1975-97, 1999-2003	3290	66	Weigh in Summary	Kona	Big Island
HIBT-Pro Am.	Hawaii International Billfish Association	1995-97,2000-01	153	22	Catch Records	Kona	Big Island
Huggo's Wahine	Vermillion's	1996-2002	190	69	Catch Records	Kona	Big Island
Rolex Champion	Vermillion's	2000-2001	88	34	Catch Records	Kona	Big Island

There are a total of 12,180 entries in the recreational metadata database. Some include more than one fish whereas others include fish that were lost or represent boats that did not catch fish. A total of 12,051 fish are described in the database. Marlins dominated the catch (Figure 15). The total weight of all reported fish combined was 857,246 pounds, with blue marlin comprising the majority of catch by weight (Figure 16).

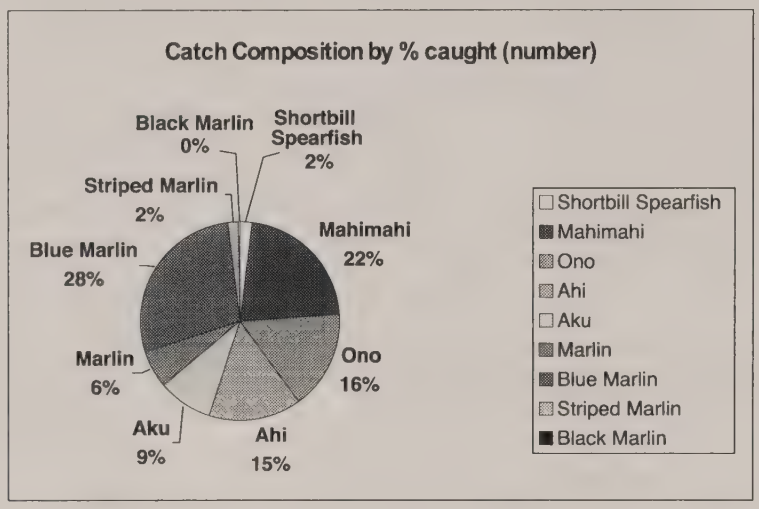

Figure 15. Total catch by number caught for all tournaments combined.

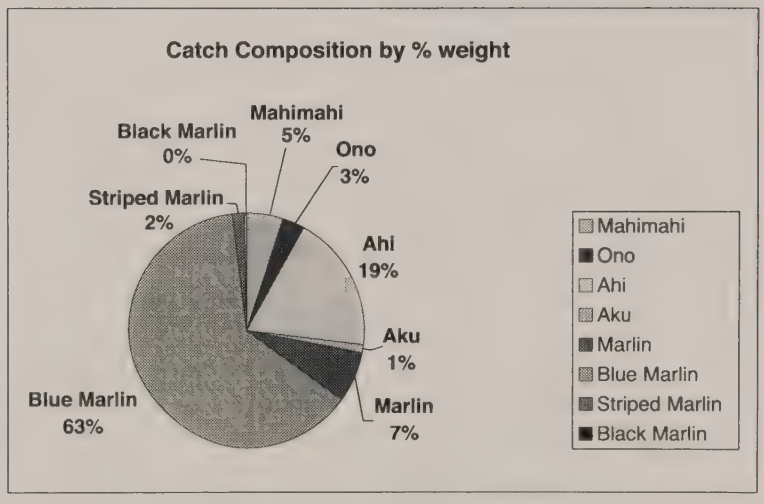

Figure 16. Total catch by weight for all tournaments combined.

In the database, the catch was dominated by blue marlin. The reasons for this are many. First, in several tournaments, points or prizes are given only for marlins (usually blue, and striped) or tuna over 100 lbs. Second, the oldest tournament, the HIBT, was the only one included in the database until 1981 (Figure 17). Therefore its catch (including only marlin and tuna over 100 lbs.) dominates the database. This theme is reflected throughout

this study. Many of the conclusions are a result, not of fishing tendencies, but of reporting idiosyncrasies. It is assumed that during many tournaments mahimahi, wahoo, smaller tuna, and other species were caught, but not always reported. Furthermore, blue marlin dominating the catch is likely an artifact of tournament fishing and not representative of recreational fishing in general. Marlin may not be the favored fish in terms of eating or fighting, but as the largest fish often wins the largest monetary prize, it is typical for tournament anglers to target this species. In addition, other fish may not be reported when a large marlin ensures a team of a victory.

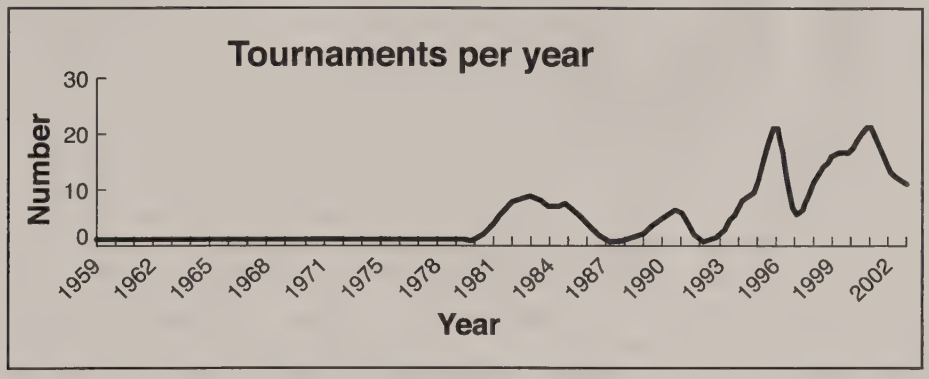

Figure 17. Number of tournaments in data base by year.

The total and average weights of fish weighed in are summarized in Table 7. The numbers reflected in the table refer only to fish weighed in, and not those that were released or without estimated weights. These weights are highly affected by the rules of the tournaments, including minimum weight requirements. The minimum and maximum weights reported in the database are also provided.

The total weight of fish increased throughout the years for several reasons. First, the total weight of fish was greatly affected by the addition of more tournaments in the database, especially local-style tournaments that give prizes for the largest mahimahi and wahoo, as well as gross tonnage. Furthermore, the total weight of blue marlin caught was significantly affected by the advent of tag and release. While all fish released are included in the number of fish caught, since they are not weighed in, they are not included in the total weight. As the number of billfish released increased through the years (Figure 18), the overall weight might be expected to decrease. However, the number of tournaments reporting data increased during this time as well. The average weight may have increased, as the minimum weight of weighed in marlin was often 300 pounds (Figure 19). Therefore, smaller fish would be released, leaving only larger marlin to be included in the averaging. Since 1990, there has also been an increase in efforts to promote non-consumptive fishing for marlins by groups working to conserve marlin populations for sport fishing (e.g., The Billfish Foundation) and many fishermen consider tag and release to be the proper way to enjoy and perpetuate the existence of their sport.

Table 7. Summary of fish weighed in at tournaments in database. Note: Species are listed as reported, thus *(otaru usually means large skipjack tuna and shibi refers to small yellowfin tuna).

Species	Number weighed	Total weight (lbs)	Average weight (lbs)	Minimum weight (lbs)	Maximum weight (lbs)	Variance of weight (lbs)	Standard deviation of weight (lbs)
Tuna	1254	163262	130	1	300	2954	54
Skipjack tuna	430	6849	16	2	80	70	8
Barracuda	10	155	16	7	40	105	10
Billfish	4	325	81	29	129	1902	44
Black Marlin	11	3145	286	141	721	27755	167
Blue Marlin	2474	540454	218	32	1106	16125	127
Kawakawa	17	102	6	1	14	19	4
Mahimahi	1558	39101	25	3	347	295	17
Marlin	394	56001	142	4	739	11257	106
Wahoo	975	27673	28	4	416	922	30
Otaru*	59	1212	21	11	30	17	4
Sailfish	11	540	49	24	78	454	21
Shibi*	8	81	10	6	14	8	3
Shortbilled spearfish	108	3498	32	7	52	61	8
Striped marlin	172	13367	78	33	165	537	23
Ulua	7	147	21	11	42	106	10

Occasionally, estimated weights were available when fish were released or reported via a radio log. These weights were not included in the data summary because they were not consistently estimated by a single source. Additionally, in the case of radio logs, there may be strategy involved in under- or over-estimating fish weights. For example, by underestimating your catch, you may convince another angler to reel in his lines before stop-fishing, convinced he has the winning fish. Graphing the difference between actual weight and estimated weight versus actual weight (Figure 20), there are many values near or at zero, suggesting that estimated weights may be accurate. However, there are several that vary, including an estimated weight three hundred pounds less than the actual weight. As one would expect, the inaccuracy of the estimates seems to increase with weight. It should also be noted that most estimates were underestimates; this may be attributed to trying to avoid embarrassment at the scales or to the strategy alluded to above.

There are 225 total events represented in the database, including 34 annual or monthly tournaments repeated over 1-42 years (Table 6). The total number of boats or participants in these tournaments was estimated to be 8,597.

The overall (all fish and all years) catch per unit effort (CPUE) expressed as the number of fish caught per boat per day is 1.4, and the overall total weight of fish caught per boat per day is 99.7 lbs (Figure 21). The number of boats participating was often estimated based upon the highest tournament assigned boat number or the total number of boats reporting a catch. This may have resulted in overestimation or underestimation of effort. Occasionally,

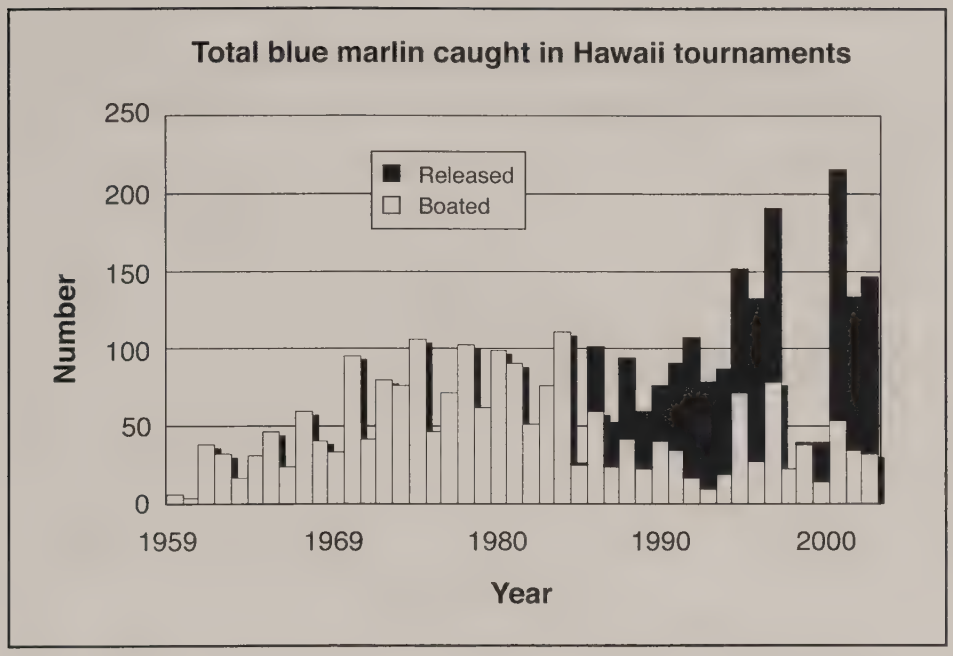

Figure 18. Total catch of blue marlin showing an increase of tag and release fishing.

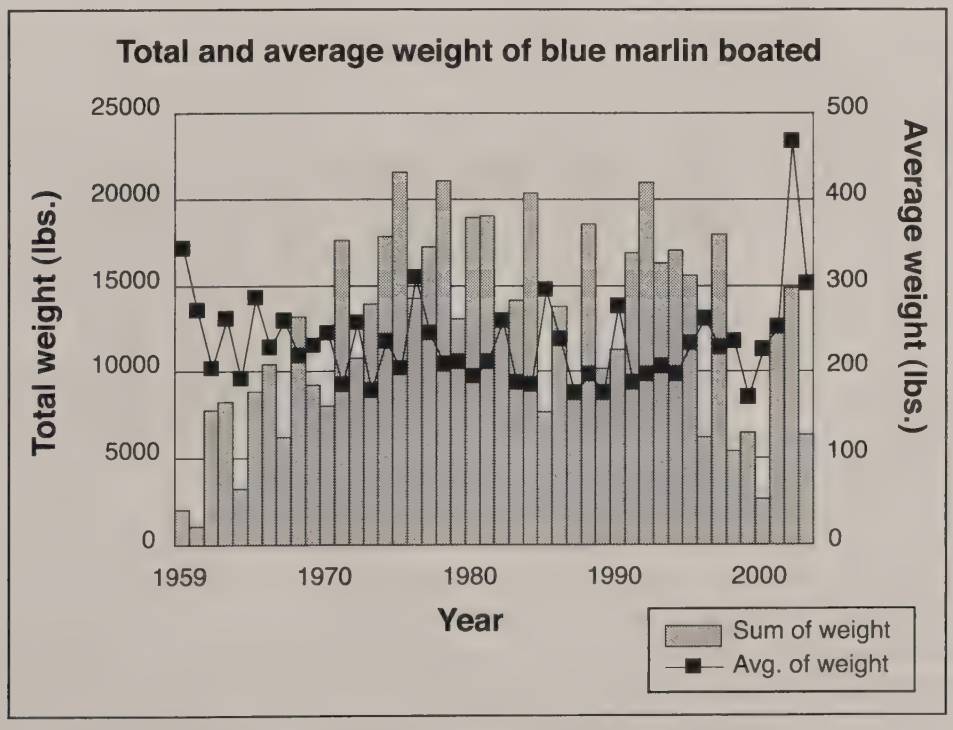

Figure 19. Total of blue marlin weights and the average weight per year for all tournaments combined.

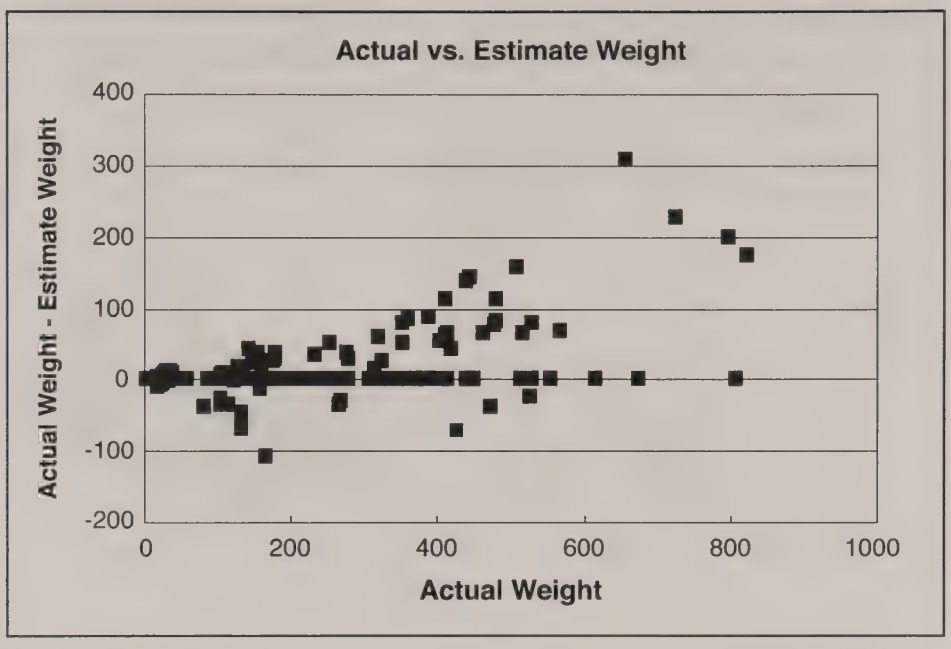

Figure 20. Actual weighed in blue marlin weights vs. estimated weights showing propensity to underestimate weight as fish gets larger.

boats withdrew from the tournament, and this may not have been taken into account when the highest tournament-assigned number was used. More frequently, effort was underestimated, as many teams would not report a low or nonexistent catch. Our calculation of CPUE is dependent upon tournament rules, minimum acceptable weights, and the qualifying species. CPUEs may be low due to the non-reporting of non-qualifying fish, e.g., either a mahimahi or wahoo caught in a marlin tournament or a fish caught that did not meet minimum weight requirements.

5.1 Catch Distribution by Island

The catch composition changed considerably by island (Figure 22). While most blue marlins were caught off the Big Island, Oahu fishermen landed striped marlin and most of the few black marlin reported. Almost half of the mahimahi landed were reported caught during Maui tournaments. Figures 23 and 24 illustrate the catch composition for each island for blue marlin and tunas, respectively. The increasing trend is a reflection of increased data reporting and the increase in the number of tournaments held every year. The composition of catch changes by island showing the importance of tuna, mahimahi, and wahoo as target species for tournaments held on Oahu and Kauai, the importance of marlin catch for tournaments held on the Big Island, and the importance of mahimahi and marlins for tournaments held on Maui (Figure 25).

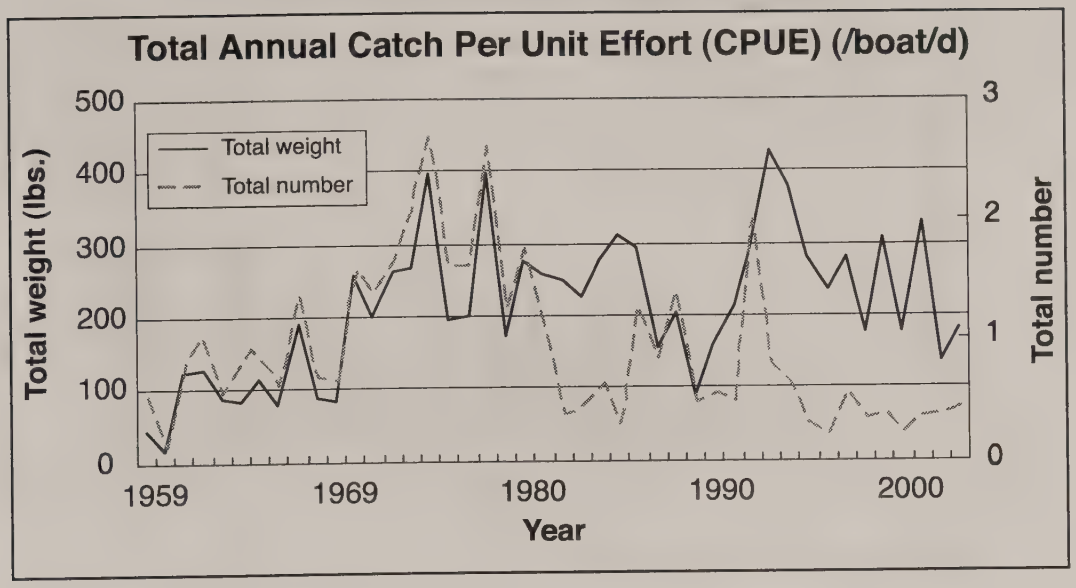

Figure 21. Total CPUE for all species and tournaments combined.

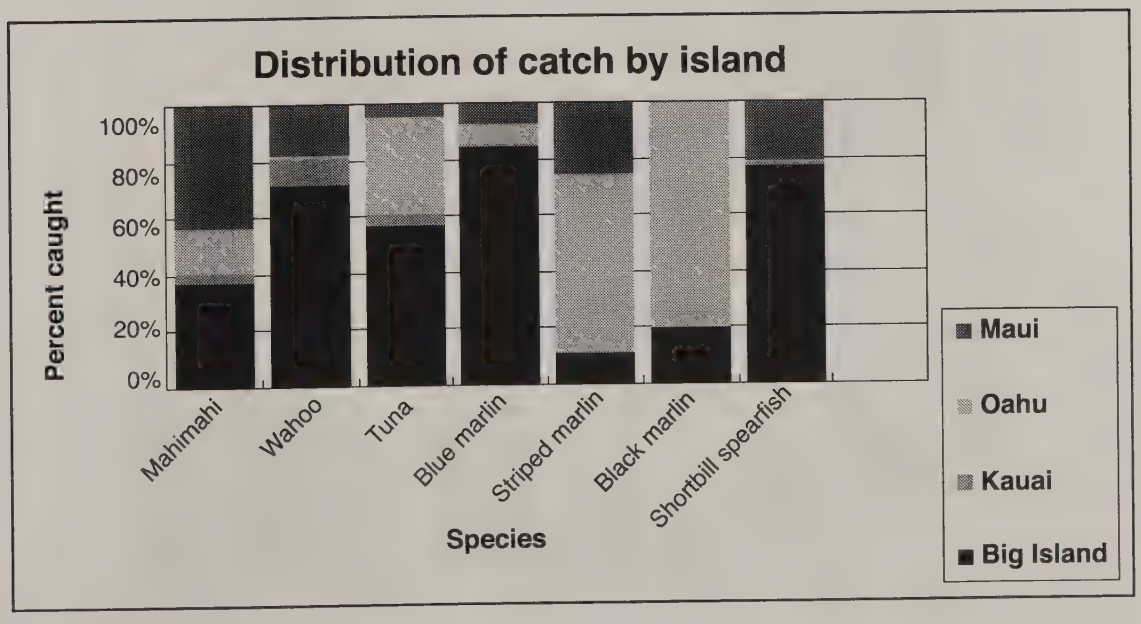

Figure 22. Catch distribution by island for all tournaments combined.

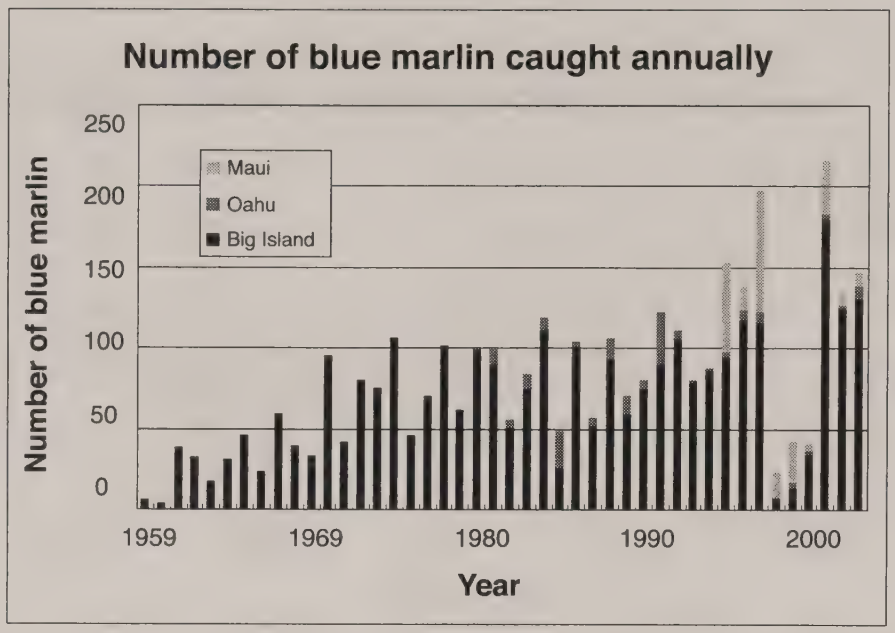

Figure 23. Number of blue marlin reported by island for all tournaments combined.

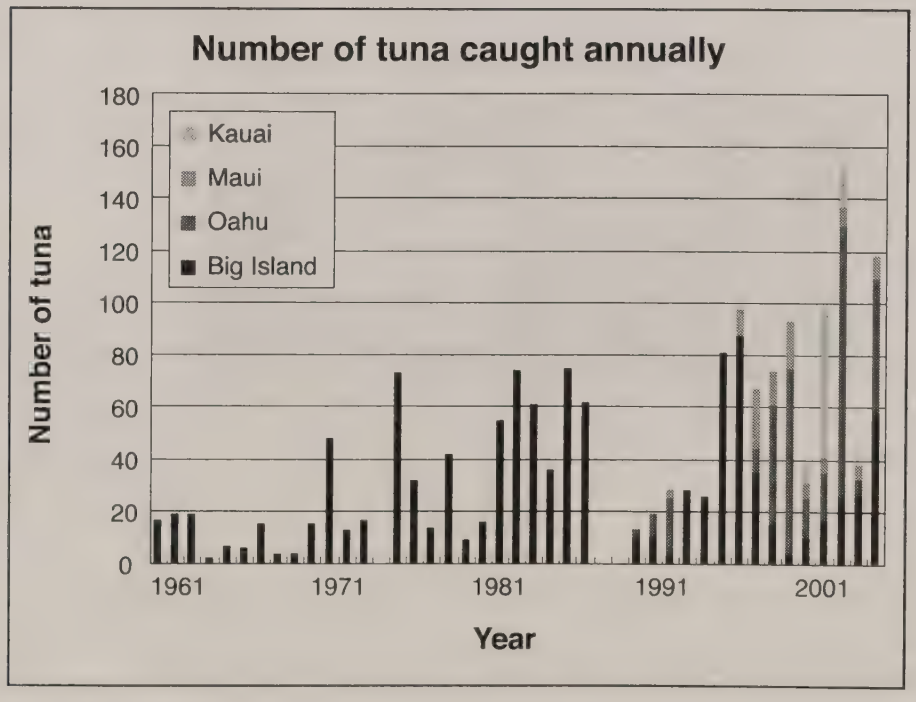

Figure 24. Number of tuna reported by island for all tournaments combined.

5.2 Catch Distribution by Tournament

Most of the catch reported is landed during the two largest tournaments, the HIBT on the Big Island and the Ahi Fever on Oahu (Figure 26). The other tournaments are significantly smaller, both in scale and in number of participants. Individual catch sorted by tournament was highly variable and we did not observe any trends in species composition at the tournament level of resolution.

5.3 Catch Distribution by Location (FAD)

Some of the radio logs and catch records also contained location information by either identification of a fish aggregation device (FAD) or the designated catch area key for that tournament. Due to the relative proximity of the main islands and the ports from which tournaments are hosted (Figure 27), most tournaments share the same maps for reporting catch areas. When this information is plotted on a map superimposed with FAD locations, the fishermen's reliance on the FAD system becomes apparent. On Oahu, we have a long time

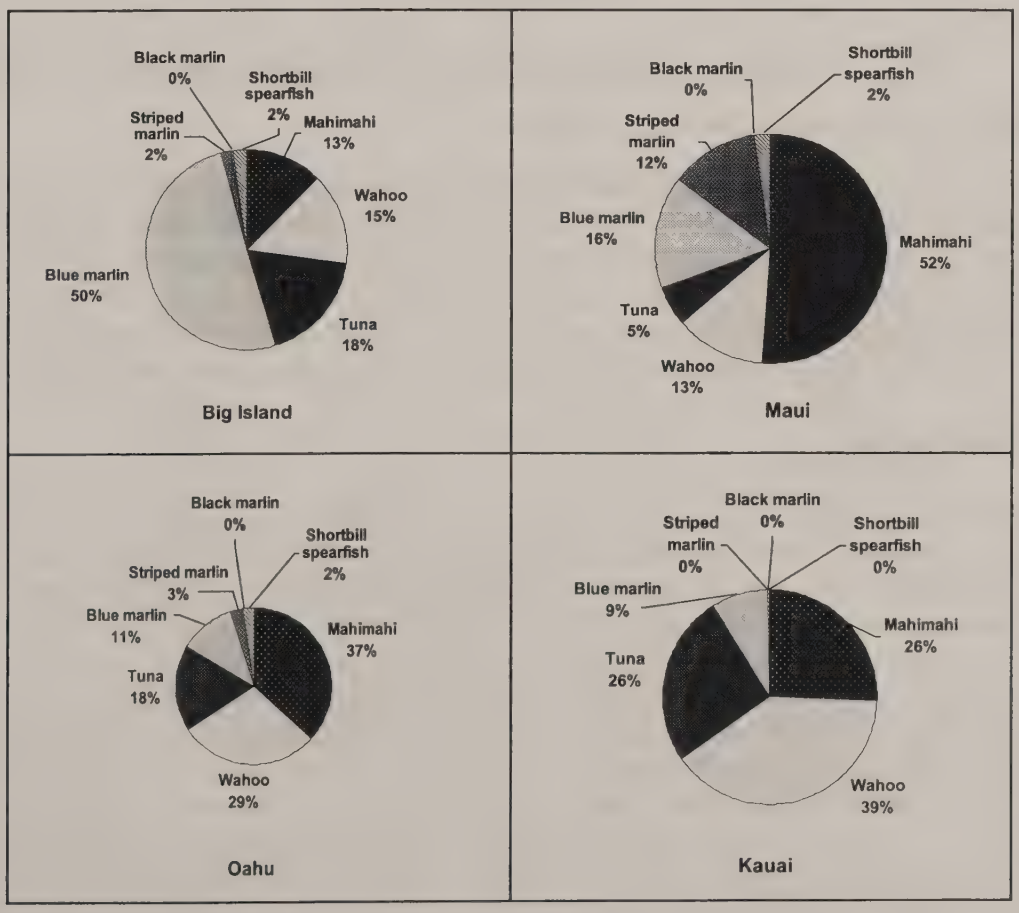

Figure 25. Catch composition by island for all tournaments combined.

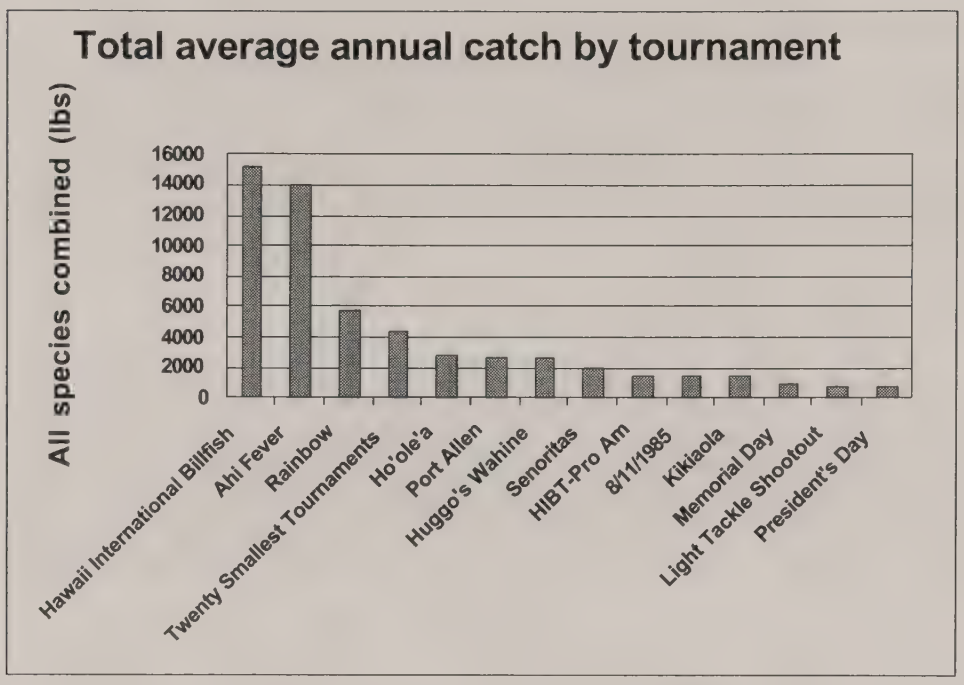

Figure 26. Total weight of catch by tournament.

series of information for a single tournament (Senoritas) that shows that over 85% of this tournament's catch is either directly FAD associated or comes from areas with FADs (Figure 28). The popularity of targeting FADs is also apparent for the HIBT and the Hilo Trollers tournaments (Figures 29 and 30). This apparent popularity of FADs may be a case of the FADs being placed in areas where fishermen would fish even without the device being present, but whatever the motivation, tournament participants are clearly targeting areas near FADs.

6 Conclusions

Though the tournament records provide insights into the nature and scope of Hawaii's pelagic recreational fishery, inconsistent or tournament-specific reporting may compromise the data. Each tournament has its own reporting procedures, affected by tradition, rules, and awards. The effect of these factors could not be teased out of the records to produce unbiased information. As with any fishery dependent data, understanding how the fishery operates is critical in understanding appropriate applications for the information gleaned. For example, some tournaments offer awards for the largest total tonnage of fish caught and do not report the number caught. Others, after indicating the weight of the largest fish of each species on a team's weigh-in slip, combine all additional fish to give a total weight of "all other fish." Though the total weight per year may reflect this, the actual number of fish per species caught annually and catch-per-unit-effort indices for species cannot be determined from a tournament that uses this reporting procedure. The graphs do not include any of the fish listed under the "all other fish" category, and thus under-represent the total number of fish caught.

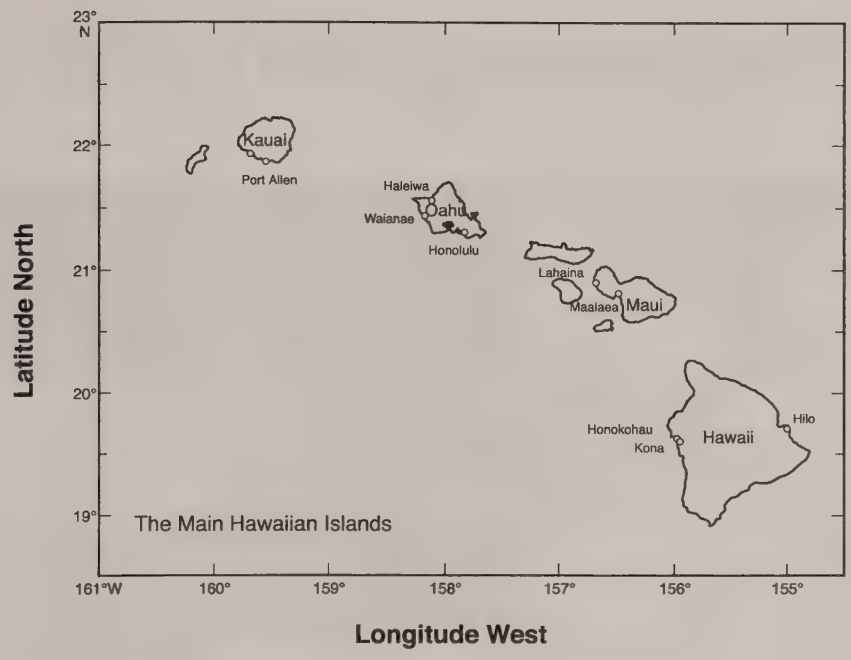

Figure 27. Map of main Hawaiian Islands and major tournament ports.

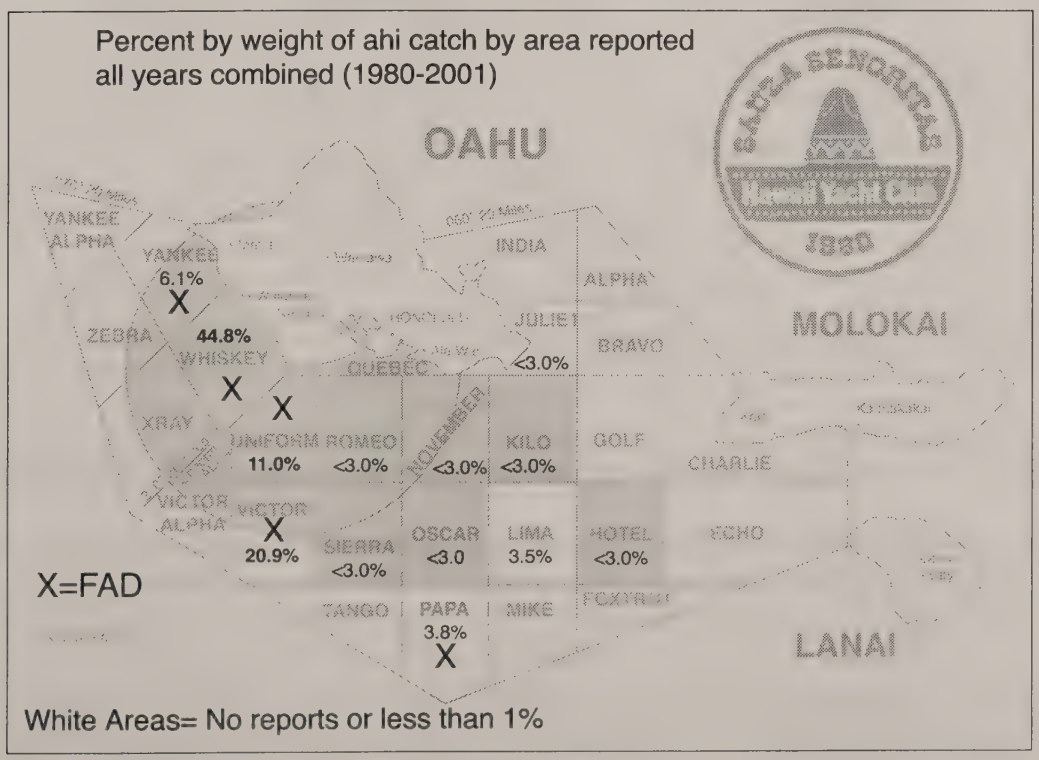

Figure 28. Total catch of tuna (ahi) for a single tournament (Senoritas) for all years combined showing popularity of FADs.

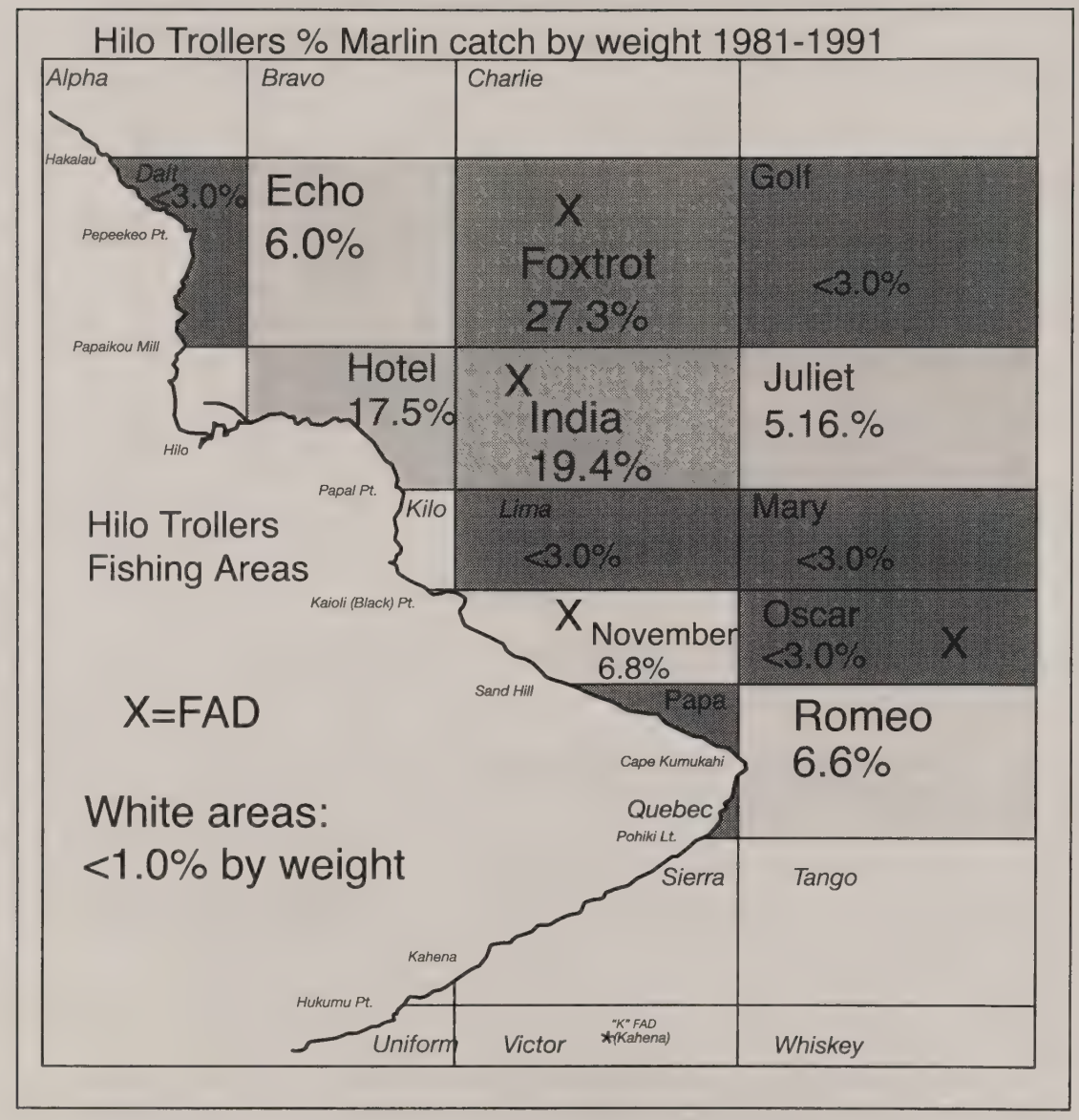

Figure 29. Percent marlin catch by weight for a single tournament all years combined.

Unfortunately, there is no standard methodology for reporting tournament catch. While some tournaments simply report the species and weight of the fish, others include the area caught, the use of live/dead bait or lure, breaking strength of line, time of strike and capture or time fought, and the disposition of the fish. In addition, species classification may vary between tournaments, years, and weigh-masters. Variation may even occur within a single catch report. For example, one tournament alternatively specifies blue, striped, or black marlin in some records and the general term of "marlin" in others. This general term appears to be used concurrently with any species because all billfish or marlins are included under a single prize category. Though reporting discrepancies make it difficult to summarize the impact and

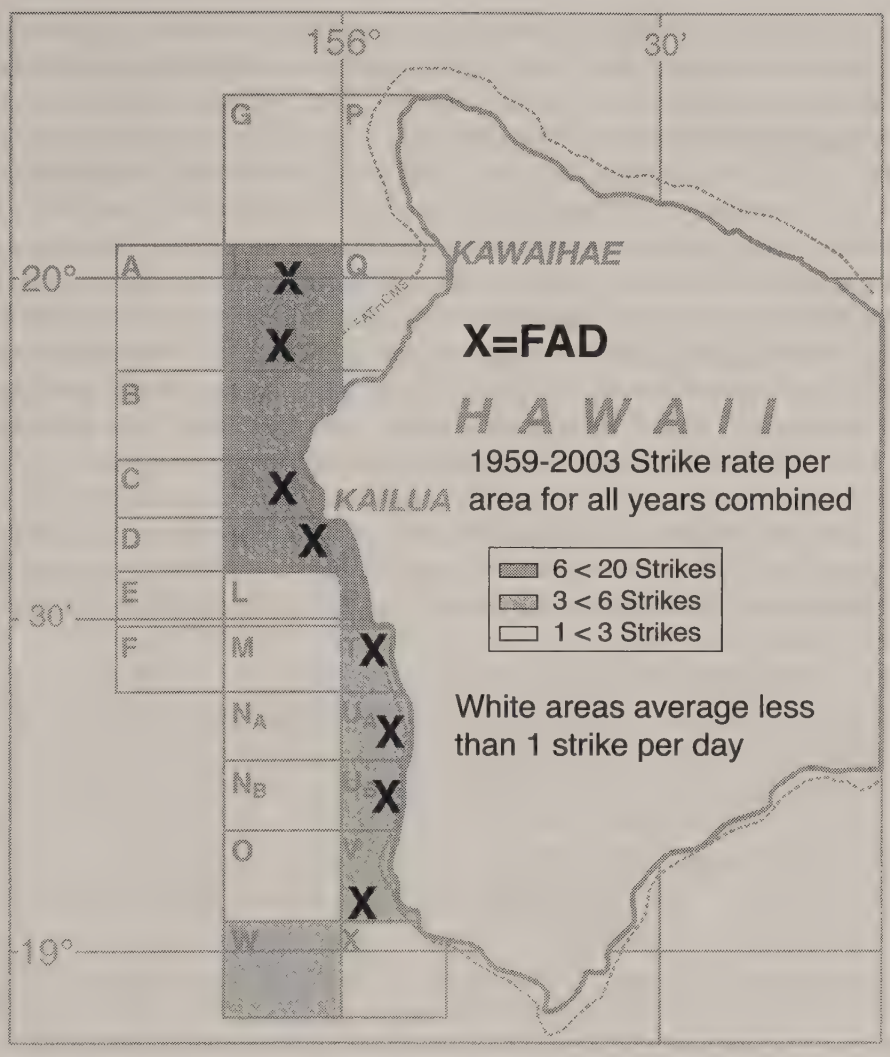

Figure 30. Reported strike rates by area for Hawaii International Billfish Tournament all years combined.

extent of tournament fishing in Hawaii, the tournament data, plotted over time, may be useful in determining cyclical peaks in catch or local abundance of different species

Even with the flaws inherent in fisheries dependant data and given the idiosyncratic nature of individual tournament activities, three conclusions can be drawn from the data and stated with confidence:

1. *Tournament participants clearly show a reliance on the network of FADs to target their activities.* This reliance on FADs extends across all islands and all tournaments, and if the tournament fishermen are actively targeting FADs, the non-tournament related recreational fishermen probably heavily utilize FADs also. The predilection of tunas and other pelagic fish species for congregating near floating objects has long been documented by fishermen

and researchers (Hunter and Mitchell, 1968). This knowledge has led to experimentation with, and development of, moored floating devices placed near fishing ports in an effort to enhance the fisherman's opportunity to target pelagic fish. In Hawaii the development of such FADs began in 1977 with the placement of six experimental devices near the islands of Oahu and Lanai (Matsumoto et al., 1979). This project was initially intended to support Oahu's skipjack tuna fishery, which traditionally spent hours searching for bird flocks (known to be associated with schools of small tunas and skipjack). Initial results were encouraging in that FADs not only assisted the skipjack fishery, but attracted trollers and commercial handliners. Even "drop stone" fishermen (who traditionally only fish at night) began conducting daylight operations at and around FAD locations. The initial success led to a statewide implementation of FADs around all the main islands and the state now oversees a system of 55 surface FADs for fishermen to frequent (http://www.hawaii.edu/HIMB/FADS/). Though the original FADs were developed to augment the skipjack fishery (which has since declined due to closure of the Hawaiian Tuna Packers cannery in 1984), the usage of FADs by tournament and other fishermen has been reflected in all of our data for all the tournaments and in all our discussions with tournament organizers. Many tournament organizers report that some of their participants plan their trolling routes by using FADs as waypoints for their daily fishing route.

2. *A greater percentage of blue marlin are tagged and released than ever before.* This is not insignificant, in that many recreational anglers have accepted tournament policy of tag and release. Though tournament tag and release is accompanied by earning points, anglers may also be receptive to a statewide tag and release program for marlin beneath a certain weight.

3. *Catch targets do change by island and catch composition trends may be indicative of relative stock abundance around each island.* The idiosyncratic nature of tournament rules and reporting methods preclude us from drawing any conclusions about local stock abundance or seasonal movements from these data. However, there does appear to be a preponderance of marlin catch in the southeast part of the island chain (Big Island and Maui) and a shift towards tuna catch in the northwest part of the chain (Oahu and Kauai), and this may reflect relative abundance trends throughout the islands. Mahimahi also appear to be more prevalent near Maui, but this may be an artifact of tournament reporting procedures and not an actual indication that mahimahi are concentrated around Maui.

It is possible to continue to collect tournament records as a source of catch and effort data from the recreational fishery. These data should be considered in light of the varied rules of each tournament. In addition, these data only apply to tournament anglers, who have the added incentive of large prizes added to their motivations for fishing. These tournaments, which are held mainly during the weekends between June and August, are a significant yet small fraction of all recreational fishing. A more accurate and complete account of the recreational fishery (sans the tournament fishery) could be achieved by analyzing the HMRFS survey coordinated by the Hawaii Department of Aquatic Resources. The HMRFS project has only recently returned to Hawaii (http:\\www.hawaii.gov/dlnr/dar/surveys/index.htm), thus there is still a large gap in the amount of historical documentation of recreational fisheries in Hawaii.

The total catch by tournament participants adds up to tens of thousands of pounds of fish per year. While some of this catch is sold and documented by the State of Hawaii, most of these fish are never documented nor included in fishery catch statistics. Some of this catch was reported to the State of Hawaii, thus to avoid duplicate records, no State of Hawaii collected data were incorporated within this tournament database. In 2003, a preliminary report on recreational fisheries estimated that over 42 million pounds of fish were landed in Hawaii and of this total, 18.9 million pounds originated from the recreational sector (http://www.wpcouncil.org/pelagic.htm#AnnualReports); these totals do not include unsold tournament catches. The HMRFS study does collect and is analyzing tournament and charter data, but it currently excludes such information from its scope of reporting duties. Thus an important segment of Hawaii's recreational pelagic catch is not taken into account. An accurate assessment of the total recreational catch is needed to enable fisheries management agencies to make fully informed decisions regarding pelagic fisheries in Hawaii.

The tournament data described in this report offers meaningful insights into the present day tournament segment of Hawaii's recreational fishery and also helps to fill the gaps for the many years when little or no documentation of recreational fishing activities was conducted. This project illustrates the need for greater effort in documenting recreational fishing activities in Hawaii. Whether this would require a marine recreational licensing system to develop the infrastructure necessary for comprehensive data collection, or could be accomplished simply through more frequent studies and surveys like this project and the HMRFS study is uncertain. What is certain is that there is a vast amount of information and activity in the recreational sectors of Hawaii's pelagic fisheries that currently goes unreported. A comprehensive, statewide system to monitor and analyze such information would go a long way towards filling this critical information gap.

7 References

Allen, G. 1950. *Hawaii's War Years*. Pacific Monograph, Honolulu, HI.

Ball, J. 1975. Fisheries and the state of Hawaii input to the national fisheries plan. *Working Paper No. 4, Sea Grant College Program*. University of Hawaii. 80 pp.

Gaffney, R. 2000. Evaluation of the status of the recreational fishery for ulua in Hawaii and recommendations for future management. *DAR Tech. Rep. 20-02*, October 2000. Division of Aquatic Resources, Honolulu, HI.

Glazier, E. 1999. Social aspects of Hawaii's small vessel troll fishery. Phase II of the Social Aspects of Pacific Pelagic Fisheries Program, University of Hawaii. 287 pp.

Hamilton, M. 1998. Cost-earnings study of Hawaii's charter fishing industry 1996-1997. Pelagic Fisheries Research Program, University of Hawaii, Joint Institute for marine and Atmospheric Research, 1000 Pope Rd., Honolulu, HI 96822. 109 pp.

Hunter, J. and C. Mitchell. 1968. Field experiments on the attraction of pelagic fish to floating objects. J. Cons., 31: 427-434.

Kahiapo, J. and K. Smith. 1994. Shoreline creel survey of Hilo Bay Hawaii: 1985-1990. A report on research for the Main Hawaiian Islands Marine Resources Investigation (MHI-MRI). Division of Aquatic Resources, Department of Land and Natural Resources, 1151 Punchbowl St., Room 330, Honolulu, HI 96813. 31 pp.

Maharaj, V. and J. Carpenter. 1996. The 1996 economic impact of sport fishing in Hawaii. American Sportfishing Association, 1033 North Fairfax St. Suite 200, Alexandria, Virginia 22314. 10 pp.

Matsumoto, W., T. Kazama, and D. Aasted. 1979. Anchored fish aggregation devices in Hawaiian waters. Honolulu Lab., Southwest Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Sci. Cent.Admin. Rep. H-79-19. 35 pp.

Schug, D. 2001. Hawaii's commercial fishing industry: 1820-1945. Hawaiian J. History, 35:15-34.

Websites

Hawaii Division of Aquatic Resources. Hawaii Marine Recreational Fisheries Survey. http://www.hawaii.gov/dlnr/dar/surveys/index.htm

NOAA Fisheries Pacific Islands Fisheries Science Center. Recreational Metadata Project. http://www.nmfs.hawaii.edu/fmsd/hdrp/rec_literature.php

Western Pacific Regional Fisheries Management Council. Pelagic fisheries of the Western Pacific region 2003 preliminary annual report- Appendix 6 Recreational fisheries. http://www.wpcouncil.org/pelagic.htm#AnnualReports

Appendix: Table of Recreational Literature Available on Website

PELAGIC RECREATIONAL FISHERY LITERATURE
(Recreational Meta Data Project) http://www.nmfs.hawaii.edu/fmsd/hdrp/rec_literature.php

Year	Author	Title	Tables
2002	Seki, M.; Lumpkin, R.; Flament, P.	Hawaii cyclonic eddies and blue marlin catches: the case study of the 1995 Hawaii International Billfish Tournament	
2002	USFWS	2001 National survey of fishing, hunting and wildlife-associated recreation (Outside link)	
2001	McConnell, K.E.; Haab, T.C.	Small boat fishing in Hawaii: choice and economic values	Tables
2001	Miller, M.; et.al.	Proceedings of the 1998 Pacific Island Gamefish Tournament Symposium	
2001	O Malley, J.; Glazier, E.	Motivations, satisfaction and expenditures of recreational pelagic charter fishing patrons in Hawaii	Tables
2000	Williams, P.; Whitelaw, A.	Preliminary estimates of annual catches for billfish species taken in commercial and recreational fisheries of the western and central Pacific Ocean	
1999	Glazier, E.	Non-commercial fisheries in the central and western Pacific: a summary review of the literature	
1999	Hamilton, M.	A system for classifying small boat fishermen in Hawaii	Tables
1998	Hamilton, M.	Cost-earnings study of Hawaii's charter fishing industry, 1996-1997	
1998	Hamm, D.; Chan, N.; Quach, M.	Fishery Statistics of the Western Pacific, Volume XIII	
1998	Pan, M.	Multilevel and multiobjective programming model for Hawaii fisheries management	Tables
1998	USFWS	1996 National survey of fishing, hunting, and wildlife-associated recreation, Hawaii (Outside link)	
1997	Friedlander, A.; Parrish, J.	Fisheries harvest and standing stock in a Hawaiian bay	Tables
1997	Hamilton, M.; Huffman, S.	Cost-earnings study of Hawaii's small boat fishery, 1995-1996	Tables
1997	Maharaj, V.; Carpenter, J.	The 1996 economic impact of sport fishing in Hawaii	Tables
1997	Walker, J.	Sociology of Hawaii charter boat fishing	Tables
1996	Miller, M.	Social aspects of pacific pelagic fisheries, Phase I: The Hawaii troll and handline fisheries	Tables
1996	Walker, J.	Work and leisure in Hawaii small boat pelagic fishing	Tables
1996		Western Pacific Regional Report	Tables
1996	Seki, M.	The 1995 Hawaiian International Billfish Tournament:an oceanographic perspective	Tables

1994	Everson, A.	Fishery data collection system for fishery utilization study of Kaneohe Bay two-year interim report	Tables
1994	Kahiapo, J.; Smith, M.	Shoreline creel survey of Hilo Bay Hawaii: 1985-1990	Tables
1993	Boggs, C.; Ito, R.	Hawaii s Pelagic Fisheries	
1993	Pooley, S.	Economics and Hawaii's marine fisheries	
1993	Skillman,R; Boggs, C.; Pooley, S.	Fishery interaction between the tuna longline and other pelagic fisheries in Hawaii	Tables
1993	Pooley, S.	Hawaii's marine fisheries-some history, long term trends, and recent developments	Tables
1992	Hamm, D.; Lum, H.	Preliminary results of the Hawaii small-boat fisheries survey	
1992	Pooley, S.	NMFS Hawaii pelagic fisheries program	
1991	Pooley, S.	NMFS Honolulu Laboratory position paper on Hawaii pelagic fisheries information	
1991	Pooley, S.	Marine fisheries social science research priorities	
1991	Sakoi, K.	Estimating the net-economic value of blue marlin in Hawaii	
1990	Pooley, S.	FMP monitoring and assessment workshop report	Tables
1989	USFWS	National Survey of Fishing, Hunting and Wildlife-Associated Recreation	
1989	Kasaoka, L	Summary of small boat economic surveys from American Samoa, Guam, and the Northern Mariana Islands	
1989	Pooley, S; Baxter, J.; Higuchi, W.	East Hawaii commercial fishing mooring and launching facility project: economic and resource analysis	Tables
1988	Omnitrack Research & Marketing Group, Inc.	Sampling methodology for a boat fishing survey design for Hawaii	Tables
1988	Pooley, S.	Kahului small fishing boat facility: alternative net benefit estimates	Tables
1988	Pooley, S.	Report on Oahu small boat harbor fishery potential-Heeia Kea and Maunalua Bay	Tables
1987	Meyer, P.	A report on resident fishing in the Hawaiian islands	Tables
1987	Shomura, R.	Hawaii's marine fisheries resources: yesterday (1900) and today (1986)	
1987	Squire, J.	Pacific billfish angler catch rates for key area stock assessments	
1986	Samples, K.	A socioeconomic appraisal of fish aggregation devices in Hawaii	Tables
1985	Holland, K. N.	Seasonality of catch per unit effort of the sport fishing fleet at Kewalo Basin, Hawaii (UNIHI-SEAGRANT)	Tables
1985	Samples, K.; Shug, D.	Charter fishing patrons in Hawaii: a study of their demographics, motivations, expenditures, and fishing values	Tables

1985	Sumida, R.; Ito, R.; Draper, J.	Inventory and uses of vessels in Hawaii	
1984	Samples, K.; Kusakabe, J.; Sproul, J.	A description and economic appraisal of charter boat fishing in Hawaii	
1984	Skillman, R.; Cooper, J.	Cross tabulations of catches of large pelagic species based on Hawaii commercial catch reports, January 1976-April 1981	Tables
1984	Skillman, R.; Cooper, J.; Locey, D	Inventory of U.S. vessels in the central and western Pacific: Phase I- Summary of Public Record	Tables
1984	Skillman, R.; Louie, D.	Inventory of U.S. vessels in the central and western Pacific: Phase 2- verification and classification of Hawaiian vessels	Tables
1984	Skillman, R. Locey, D.; Cooper, J.	Cross tabulations of catches of large pelagic species based on Hawaii commercial catch reports, January 1976-April 1981	
1983	CIC Research Inc.	Fishery data collection system: Saipan	Tables
1983	Hida, T.; Skillman, R.	A note on the commercial fisheries of Hawaii	Tables
1983	Samples, K.; SMS Research	Experimental valuation of recreational fishing in Hawaii	
1983	NMFS	The 1976-78 studies of the Kailua-Kona, Hawaii, billfish fishery: charter boat operators component	
1983	NMFS	The 1976-78 studies of the Kailua-Kona, Hawaii, billfish fishery: charter boat patrons component	
1983	Wetherall, J; Yong, M	An analysis of some factors affecting the abundance of blue marlin in Hawaiian waters	
1982	Human Sciences Research	Marine recreational fisheries survey: catch and effort statistics	Tables
1982	NMFS	The 1976-78 studies of the Kailua-Kona, Hawaii, billfish fishery: commercial/recreational component	
1982	NMFS	Fishery data needs of the National Marine Fisheries Service in the Hawaiian archipelago	
1982	NMFS	Marine recreational fishing statistical survey Hawaii 1979-81	Tables
1979	Lenarz, W.; Zweifel, J.	A theoretical examination of some aspects of the interaction between longline and surface fisheries for yellowfin tuna, *Thunnus albacares*	Tables
1978	Adams, M	Alternative estimates of net economic benefits for billfish-tuna recreational-commercial fishermen in Kailua-Kona, Hawaii	Tables
1978	Cooper, J.; Adams, F	Preliminary estimates of catch, sales, and revenue of game fish for the fishery conservation zone around the Main Hawaiian islands, by types of troll and longline vessels and by species, 1976	Tables
1977	Yuen, H.	Report of the 19th Hawaiian International Billfish Tournament	
1975	Ball, J.	Fisheries and the state of Hawaii input to the national fisheries plan	

1974	Yuen, H.	Report of the 16th Hawaiian International Billfish Tournament	
1972	Hoffman, R.; Yamauchi, H.	Recreational fishing-its impact on state and local economies	Tables
1973	Naughton, J.	Investigations of billfish biology at the Hawaiian International Billfish Tournament	Tables
1968	MacKellar, J.S.	Hawaii Goes Fishing, Chapter 5: Big Game Fishing	Tables
1961	Lublin, McGaughy & Associates	Recreational boating in Hawaii	
1944	Hosaka, E.	Sportfishing in Hawaii; Chapter 30:Big Game Fishing	Tables
1947	Brock, V.	Report of the Director, Division of Fish and Game	
1940	Wilson, H.	Report of the Director, Division of Fish and Game	
1935	Kelly, H.	Report of the Director, Division of Fish and Game	
1930	Kelly, H.	Report of the Chief Territorial Warden	
1928	Kelly, H.	Report of the Chief Territorial Warden	

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